The Electrical Review

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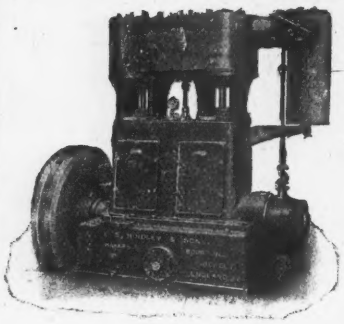

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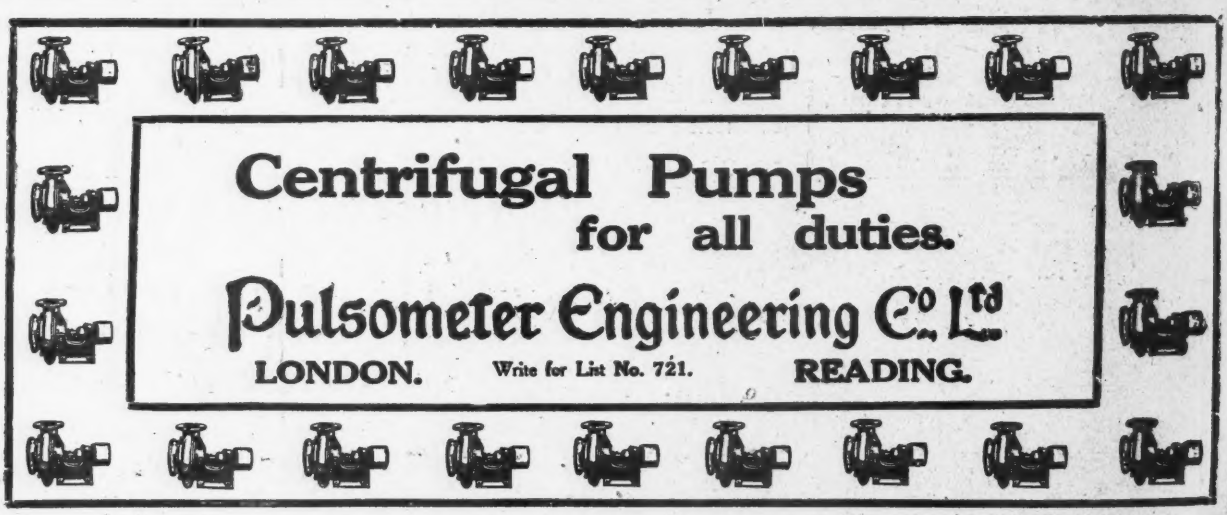

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THE
ELECTRICAL REVIEW.

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WAYLEAVES.

THE statement which we publish elsewhere in this issue, emanating from Mr. W. A. Chamen in his official capacity as Chairman of the Joint Committee of the I.M.E.A. and the I.A.E.P.C., is of exceptional interest and importance. It will be observed that the Committee proposes to introduce a Bill at the first opportunity, which, amongst other provisions, is intended to secure compulsory powers for the erection of overhead or underground cables across private property with or without the consent of the owners, subject to the issue of a certificate by the Board of Trade declaring the construction of such lines to be desirable on the ground of public utility. Owners desiring to oppose the grant of the certificate will be given one month in which to lodge their objections, after which the Board may issue or withhold the certificate with or without a local inquiry. The right of the owner to compensation, agreed upon or determined by arbitration, is conserved, and the appointment by the Board of Trade of an arbitrator "sitting continuously" to settle such questions is provided for; the possible establishment by Parliament of a new authority to take over from the Board the handling of wayleaves and other matters is foreseen, but would be dealt with in the Act appointing such new body.

The right of veto at present possessed by the local authority is also to be modified, in a separate clause, which limits the veto to electric lines along or across a street, and, further, enables the Board of Trade to overide it if consent is unreasonably withheld, a not uncommon occurrence.

It was suggested in the course of the discussion on Mr. Vernier's paper that a short Bill should be introduced conferring upon electricity supply authorities powers similar to or identical with those secured by the Post Office last year; not only the author, but also other speakers, doubted the possibility of inducing Parliament to deal with the matter effectively during the war. However, the Joint Committee shows a commendable optimism in bringing forward proposals which appear to cover the whole question, and intends, in the fighting spirit that is required if progress is to be made, to press on with them as quickly as possible. There is the "will to victory"! We congratulate the Committee on this evidence of well-directed energy; the draft clauses appear to cover all requirements, so far as can be foreseen, and we trust that success will attend the efforts of the promoters to place them on the Statute Book as soon as possible.

Our only regret is that Mr. Chamen's communication was not presented during the discussion on Mr. C. Vernier's paper, in which he so admirably set forth the case for compulsory wayleaves before the Institution of Electrical Engineers. The unanimous endorsement which was accorded to his views in the discussion which followed, and the timely action of the Joint Committee, give good grounds for hoping that at last something will be done towards the removal of the chief obstacle, the offspring of greed and ignorance, which has so long hindered the development of electricity supply in the rural districts of this country. Many of the more enlightened of our landowners have learnt to realise that their land is held in

trust for the public weal, and that to treat it as a chattel over which they exercise sovereign rights is to betray the trust reposed in them. Unfortunately, however, the laws by which we are governed were cast in the feudal mould, and it is still within the power of any selfish landowner absolutely to forbid the erection of electric lines across his land, or to compel the payment of extortionate fees for the concession, with the result that some other member of the community must either pay more for a supply of electrical energy or go without, in either case suffering material injury at the hands of the despotic owner. What is demanded is not in any way oppressive to the landowner: it is only the right of access to other property across his fields, subject to the payment of a fair rate of compensation for the privilege, a principle which has been recognised by Parliament in connection with some other public services, and which is implicitly included in the principle underlying many Acts of Parliament, that all lands and goods, and even the person of the citizen, are ultimately owned by and at the disposal of the State.

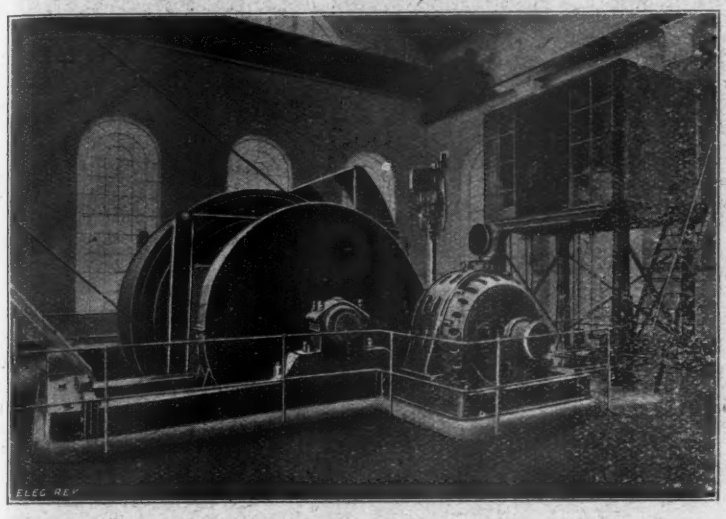
In the period of commercial stress which will inevitably follow the war, our industries cannot endure the handicap to which they will be subjected if a cheap supply of electricity is not at their disposal; and if that cheap supply is to be made available, one of the most important factors in bringing it to pass will be the coupling up of neighbouring generating stations, in order to economise fuel, plant, and labour. Further, our farmers must be supplied with cheap power, which can only be accomplished by carrying the lines overhead and across country. The securing of facilities to run overhead lines wherever they may be necessary is therefore one of the most urgent conditions that must be fulfilled to assist in the maintenance of our industrial supremacy and the provision of remunerative employment for our millions of workpeople. Public opinion in these times is pliable, and can be moulded as never before; our Government is more nearly wide awake than any of its predecessors within the past half-century, and the grant to the Post Office of powers similar to those sought by the electricity supply industry constitutes a useful precedent. It remains only for words to be followed, as Mr. Williams put it, by *action*. It is up to the Institution of Electrical Engineers, the Incorporated Municipal Electrical Association, the Associated Power Companies, and other bodies concerned, such as the British Electrical and Allied Manufacturers' Association, &c., to come together and agree to bring their united weight to bear, in order to induce Parliament to grant the necessary powers with the least possible delay. Already the Board of Trade has taken definite and positive steps towards the development of cheap electricity supply, and without doubt this department could be depended upon as an invaluable ally. We hope that the leaders of the industry will lose no time in devising means to exert the utmost possible pressure upon Parliament to secure this long-needed reform.

The Complete Union.

When the Minister of Munitions and the Director of National Service received the important deputation of manufacturing industries in March (see Elec. Rev., May 4th, p. 486), it was stated that some of the difficulties of manufacturers had been greater than perhaps they would have been had the employers been sufficiently organised. It seemed that in its dealings with organised Labour negotiations had sometimes been more easily conducted because of representative Union committees being able to advise Government departments concerning various questions affecting Labour. The difficulties of conducting negotiations with Labour have, however, been great, and at times not followed by success, as, unfortunately, we have had evidence during the past fortnight. For a long time past when such problems have been under discussion it had been widely recognised that in order to ensure satisfactory conduct of negotiations both sides must be equally well organised, but it has again been proved to demonstration, with the sad consequence that the production of munitions has been interfered with, that even unions and organisations fail us unless there is cohesion in their ranks. Mr. Hodge, the Minister of Labour, in moving the second reading of the Trade Union (Amalgamation) Bill, on Monday last, expressed the belief that if there had been such a measure as this on the Statute Book earlier, a great deal of trouble would have been saved during the war. Lord Henry Bentinck, M.P., deals in a letter to the *Times* (May 16th) with what he describes as the causes of the present engineering labour trouble. He considers that it is born of two causes: first, tactless and clumsy handling of Labour by the Government; secondly, a deep-seated discontent continually aggravated by measures of coercion and by overwork. Mr. Hodge showed that Government Departments knew how difficult it was to deal with trades which had many separate unions to represent their interests. As matters stood, it was almost impossible for crafts to join together because the law required the support of a two-thirds majority of members before amalgamation could be effected. He instanced a particular industry in which there were no fewer than nine unions all catering for the same class of worker, with the result that nine arbitration cases had had to be listened to where, with complete organisation, one would have sufficed, for the ultimate award was practically the same in all cases. Delays naturally followed, and delays cause friction, and a little friction in a number of places may easily spread until comparatively small demands or grievances may involve armies of workers. The Bill was read a third time on Tuesday, Mr. Hodge accepting slight amendments as to the strength of vote and ballot required in order to effect amalgamation. In the iron and steel trades, he mentioned, there was a general agreement in favour of amalgamation, and the masters also favoured it. After the war there would be a great revival of those trades, and any points in dispute between Capital and Labour could be more easily handled if there were only a few unions instead of the present 15. It may be thought by some that strong Labour organisations may have great power for evil, when they are quite united in spirit and in demands, but it is to obviate some of the possibilities of evil that follow from their disorganised state that the new Bill is introduced. We have long supported the view that our manufacturing organisation must be as efficient and representative as we can make it, so that it may deal authoritatively with the changing aspects of industrial situations, and may assist the Government of the day. But we also fully agree with Mr. Hodge that when the great problems of demobilisation and reconstruction have to be dealt with it will be undoubtedly in the interests of workmen, as well as of employers, that they should meet in large units. The sentiment of the manufacturer has undergone a change in recent years, and to-day, speaking generally, he would far rather deal with the men's organisations than with scattered groups of workers. The day has passed, we believe for ever, when recognition of Unions can be refused without discussion. The experiences of the coming years will show how far the Trade Union (Amalgamation) Bill, which to-day seems in theory to be a most desirable and even necessary measure, will justify itself by securing complete unity in Labour's ranks and a loyalty to leaders among the members of individual Unions.

ELECTRIC WINDING AT VICTORIA COLLIERY, EBBW VALE.

Owing to the very large area of the coal workings, the Ebbw Vale Steel, Iron and Coal Co., Ltd., proprietors of this and other mines in Monmouthshire, recently decided to enlarge an old shaft at their Victoria Colliery, taking for this purpose the old "No. 5," and widening it to 18 ft. diameter clear and 20 ft. towards the bank opening. An entirely new electrical winder and operating plant was arranged for, not only with a view to dealing more efficiently with the valuable Black Vein and Gwarycae seams, but also on account of the fine source of power available at the company's Victoria Works, with its near-by power house. Since the completion of this shaft, with its substantially designed 45-ft. headframe with 15-ft. sheaves, the old "No. 1" steam-driven shaft eqnipment has become a secondary outlet.

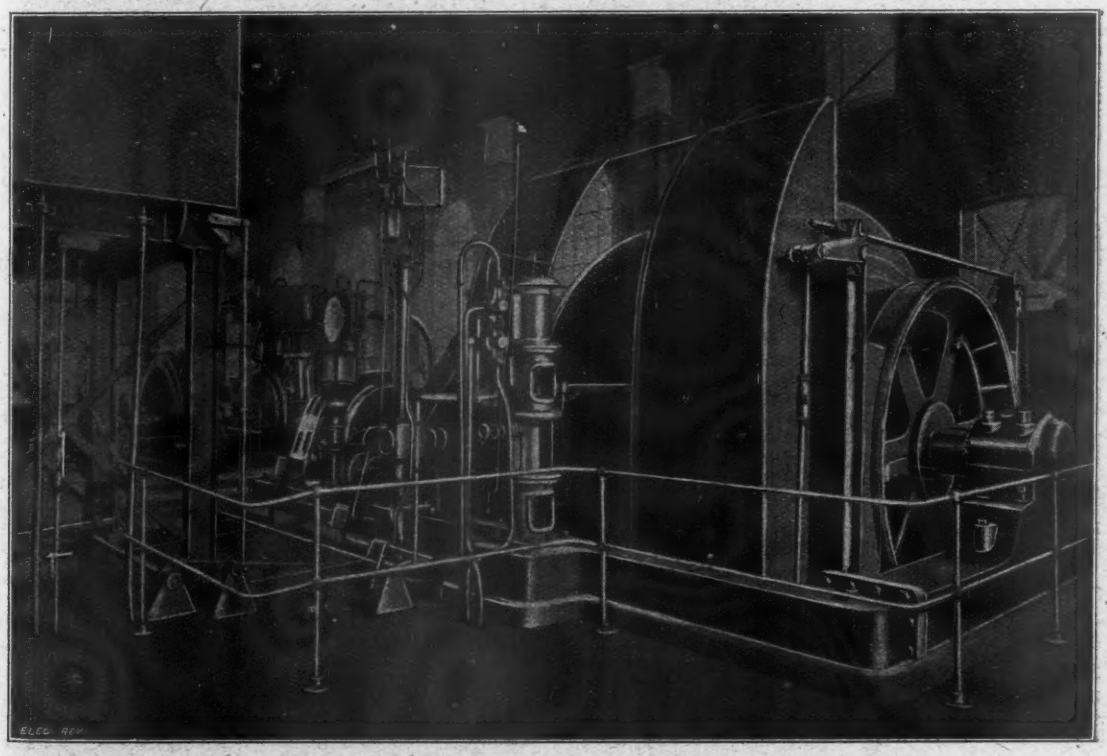


Three-phase Winder and Driver's Platform, Victoria Colliery, Ebbw Vale.

The wind at the new (or enlarged) opening is by single-deck cage, with two trams to the deck, the winder being rated to deal with a net unbalanced load of three tons of coal, with an output of 240 tons per hour, from a depth of 564 ft. A rope drum of cylindro-conical type has been adopted as most economical in practice, the diameters being 8 ft. on the small end and 13 ft. on the large part.

The winding motor is of A.I.F. Westinghouse A.C. type, 400 B.H.P. continuous rating, designed for a maximum full load speed of 360 R.P.M., and drives the drum through a Citroen speed reduction gear with a ratio of 8·6 to 1, an oil-tight gear case being fitted. Specially built for winding service, the motor is so designed as to be capable of with-standing heavy overload peaks. Here the electric winder possesses very marked advantages over the steam winder, for the latter, when faced with serious overloading, simply would not start, or, even if sufficient boiler pressure were available, would be very materially reduced in rate of acceleration. The motor is fitted with two bracket bearings, and, in addition, a third pedestal-bearing accommodating the journal for the driving-pinion shaft.

Renewable treads are fitted to the brake paths, while the drum is carried upon a powerful shaft, this, in accordance with the requirements of the Mines Act, being bored throughout its length. The post-type brakes are weight-operated and regulated by means of an 8½ × 12 in. air-brake engine, fed by a motor-driven compressor. An auxiliary transformer is installed, in order to supply the power for the compressor and controller-pump motors, also the emergency brake solenoid. It should here be noted that, in this case, the compressor is started and stopped automatically by means of an air governor switch, so that the receiver pressure is maintained within the proper working limits. The control apparatus for the rotor is of the Westinghouse liquid-resistance type, regulation being effected by the following means :—The apparatus consists of two tanks,

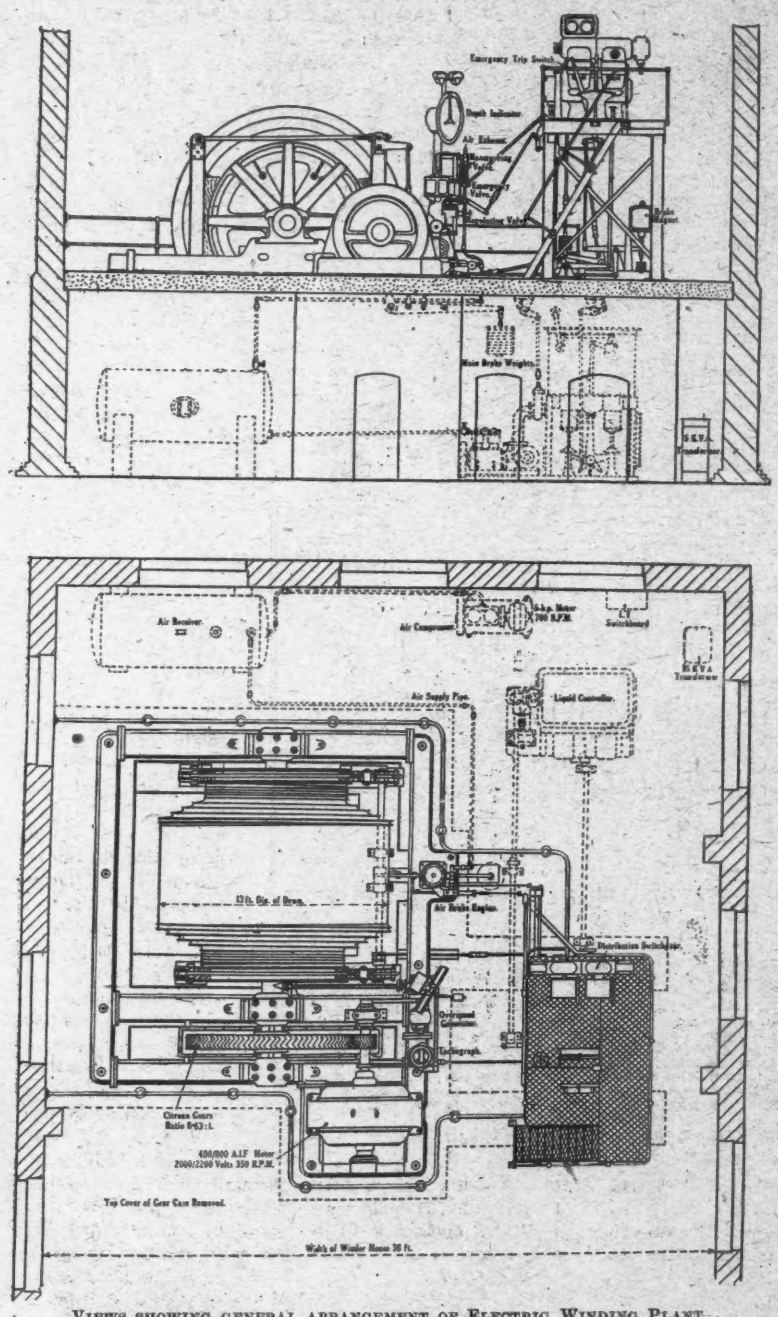


Three-phase Winding Plant, Air Compressors, &c., Victoria Colliery, Ebbw Vale.

mounted one above the other, a small motor circulating pump, an oil-immersed main reversing switch, also a main emergency switch for use if required. In the upper tank are three fixed electrodes and a movable sluice gate, the electrodes being connected with the main rotor slip rings. The supply of resistance liquid is contained within the lower tank, in which are fitted coiled pipes through which cooling water is circulated. A small motor-driven pump near the tanks lifts the resistance liquid to the upper tank, whence it returns to the lower one over the sluice gate, which reaches its lowest position when the driver's operating lever is at "off." Movement of this lever throws the main reversing switch on the motor circuit in one or other direction (according to drum rotation), and raises the sluice gate. The latter in turn causes the level of liquid in the upper tank to rise, consequently decreasing the resistance between slip-rings. The gate may be left in any position, or immediately thrown to the highest point, this depending upon manipulation of the operating lever. As, however, the liquid obviously cannot follow the gate-raising operation quicker than the pump can raise the liquid to the higher level, a certain maximum motor acceleration (due to rate of decrease of rotor circuit resistance) cannot be exceeded, although lower accelerations may be obtainable. The amount of maximum acceleration is easily adjustable by means of a stop-valve in the pump delivery pipe.

In addition to the auxiliary action of the controller pump, and as a further precaution against possible mishandling of the winding gear, the well-known Westinghouse overspeed device is fitted, which not only limits the maximum winding speed, but also prevents excessively quick acceleration.

A small D.C. generator, driven from the motor shaft, maintains a constant current through a tripping relay so long as its voltage rises only in proportion to the amount of resistance switched into the circuit during acceleration, and also provided that after acceleration its speed does not exceed the designed speed. Should at any time the current limit be exceeded, the no-volt coil circuit of the main oil switch is broken, thus causing the brakes to operate and bring the winder to rest. The main control switch pillar is mounted on the driver's platform, and fitted with an automatic oil switch having overload and no-volt trips. There is also fitted a mechanical trip, this being connected by means of rods to the overwind tappets on the depth indicator, so that in the event of an overwind the plant is shut down, and automatic braking also effected. By the foregoing, it will be seen that both control and safety devices are amply provided for. The current available is supplied at 2,000 to 2,200 volts, three-phase, 50 cycles, and iron-clad switchgear is fitted throughout the installation.



VIEWS SHOWING GENERAL ARRANGEMENT OF ELECTRIC WINDING PLANT, VICTORIA COLLIERY.

This interesting winding plant was installed by the British Westinghouse Electric and Manufacturing Co., Ltd., the sub-contractors for the mechanical parts being Messrs. Douglas & Grant, Ltd., Kirkcaldy, and the installation being supervised by Mr. Walter Dixon, of Glasgow, consulting engineer to the colliery company. We also learn that arrangements are being made for the installation of two Sulzer-Westinghouse pumps, each capable of delivering 100,000 gallons per hour, which will replace the Cornish pumps now used for the three working levels, the intention being to equip a general pumping station which will deal with the whole area (some 1,700 acres) of this portion of the Ebbw Vale Co.'s property.

For the drawing showing the arrangement of the winding plant we are indebted to the *Iron and Coal Trades Review*, which journal mentions that three-phase 50-cycle energy is supplied to the plant from the Victoria Works power station at 2,200 volts by overhead mains, and that all the large surface motors are operated at this pressure, while underground and small surface motors are supplied with 500-volt current and the lighting circuits with 110-volt direct current.

The two main haulages below ground are driven, one by a 150-H.P. motor and the other by a compressed-air engine, two electrically-driven Belliss compressors being installed alongside the electric winding engine to give the necessary air supply to the pit. A new electrically-driven Sirocco ventilating plant capable of exhausting 175,000 cb. ft. of air per minute is also a feature of the installation.

"MAKING DO."

By "P. B."

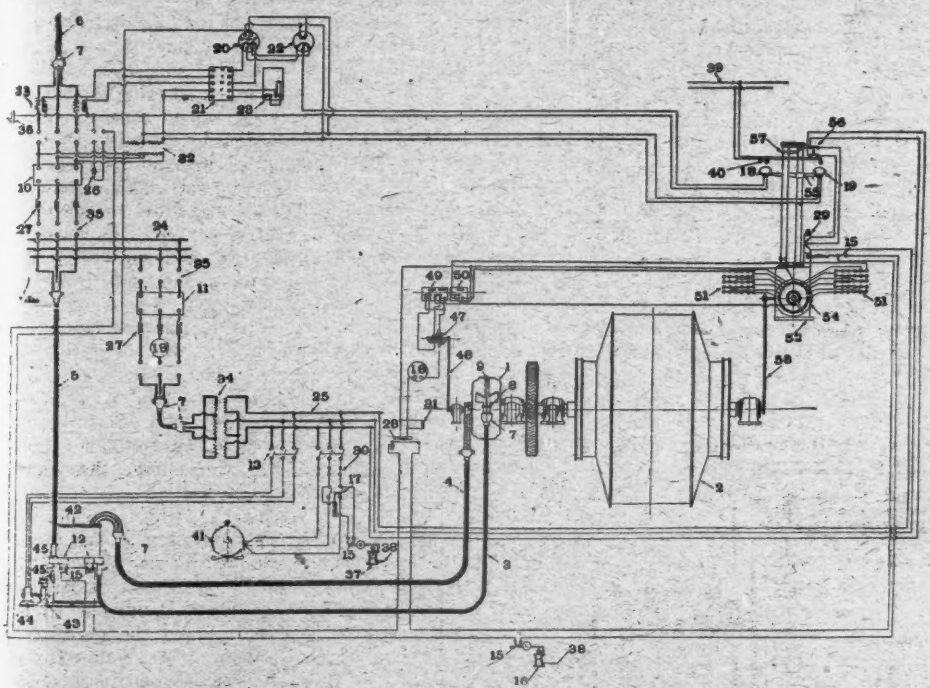
There is so much that a poor contractor cannot get nowadays, in these hard times of war-affected industries, that he is often hard put to it to make do with the unaccustomed materials upon which he is able to lay his hand as substitutes. He is forbidden to use some things, and others are unobtainable, or only obtainable in small quantities at exorbitant prices and after month-long delays.

On the other hand, his activities are restricted too, and such work as he gets is for munition or "essential" factories (which bring priority certificates in their train to ease the troubles they cannot remove), or for maintenance work and small alterations.

Now, most means of "making do" are atavistic—reversions to early practices of half-forgotten electrical pioneering. The appeal from the Cable Makers' Association to use single wires in place of three and seven-stranded cable is a case in point. In other cases, too, he may find help by looking backwards; but let none forget that, however necessary such makeshift ways and means are to-day, they are not the best, and therefore can and must be only temporary expedients for the period of the war.

After using steel conduits for two and a half decades, he is told that steel has more important uses than conduit construction, and he must ration his consumption; he falls back with happy memories on the wood casing and capping that he found so adaptable and infinite-testable (in the dry) in his apprentice days, only to be told that timber is scarce and cargo space more needed for other things; he must curb his appetite for wood. But if he cannot enclose he can cleat; if dry wood helped his tests, dry air will help more. Wires strained between insulators, cleats or other types, are unsightly but effective; the danger of damage is all patent to the passer-by, and so the risk is discounted; the work is cheap and quickly fixed, and low-insulation wire is quite good. Many an early installation worked for years, at high voltage too, with cotton-covered (and even bare) wires not only cleated, but in some cases clipped tight to the roof purlins and rafters; and bare wires in teak casing were not unknown. We are not likely to return to that stage, but porcelain-cleated work is common enough, and if glazed porcelain is difficult to procure we can turn to wood, slate, or marble.

For larger cables, which would ordinarily be drawn into steam or gas barrel, say from 2 in. to 5 in. diameter, there is cast-iron pipe to fall back on—flanged, spigot and socket, or Richardson's "P.R.J.," such as heating engineers use. For suspended work the flanged type has undoubted advantages, but the spigot and faucet holds its own underground, with joints lead-caulked for watertight work, or run in with cement if the cables themselves be lead-covered. Steel-tape armouring can be avoided in this manner, besides the large sizes of screwed tubing, which are, of course, themselves mild steel. A further very useful container for big cables, when it is not necessary to keep them absolutely watertight, is the cast-iron troughing with removable cast cover, of which one sees so many miles along the lines of London's electrified railways.



1, Winder motor; 2, Winder drum; 3, Stator cable; 4, Rotor cable; 5, Controller cable; 6, Incoming cable; 7, Trifurcating box; 8, Disconnecting plugs; 9, Neutral point box; 10, Main oil switch; 11, Auxiliary switch; 12, Reversing switches; 13, Three-pole knife switch; 14, Two-pole knife switch; 15, Single-pole trip switch; 16, Air pressure trip switch; 17, Solenoid operated switch; 18, Ammeter; 19, Voltmeter; 20, Indicating wattmeter; 21, Integrating watt-meter; 22, Power factor indicator; 23, Time switch; 24, H.T. bus-bars; 25, L.T. bus-bars; 26, No-volt coil; 27, Overload coil; 28, Relay; 29, Solenoid three-phase; 30, Fuses; 31, Shunt; 32, Shunt transformer; 33, Series transformer; 34, Current transformer; 35, Isolating plugs; 36, Earth; 37, Air governor switch; 38, Compressed-air pipe; 39, Lighting circuit; 40, Illuminating lamps; 41, Compressor motor; 42, Liquid controller; 43, Liquid controller pump; 44, Liquid controller pump motor; 45, Pump regulating valve; 46, Cooling coil water valve; 47, Overspeed generator; 48, Overspeed generator drive; 49, Overspeed field reversing switch; 50, Variable speed switch; 51, Resistances; 52, Depth indicator; 53, Depth indicator drive; 54, Rheostat faceplate; 55, Instrument arm; 56, Limit switch; 57, Depth indicator pointer.

Key Diagram of Electric Winder Connections (see facing page).

The use of copper and brass being restricted by request, these will naturally be replaced by iron in the case of wood screws, even in situations where the latter would be objected to normally, either from their discolouring the paintwork or eventually rusting. We can think about beauty again later on.

Another return to almost pre-historic methods is the substitution of iron for copper in lightning-conductor work. We are not so short of the softer metal that there is any move in the direction of pulling down old-established conductors or digging up earth-plates to melt for other purposes; but iron strip, iron collecting-points, and iron earth-plates or rods are all installed to-day as they were in the time of Faraday. It is a more cumbersome material to work with, stiffer for equal size, and bulkier for equal conductivity, but it will safeguard effectually for a time, and its principal danger is that the condition of points and plates and joints may not be examined and attended to in some future year of peace, and so lightning danger be increased instead of decreased. We must look to the needs of the moment, however, and if posterity should neglect to guard itself by due attention to maintenance details, it will be over its own head that the sword will hang.

For the sake of economising in accessories, it is now advisable to light buildings, as far as possible, by a small number of large candle-power lamps in preference to a large number of smaller lamps, even in cases where such a course departs from the best illuminating engineering standards. By so doing, economy in fittings, in lamps, and in labour will be effected, and the last will be considered far from the least of the three items. In a similar way, the grouping of a number of lamps on one switch, where this can be done without much increasing the length of wiring, is desirable; should it lead to increased current consumption (which it quite possibly will not, for most people entering a large room with several switches grouped at the

door will switch on the whole lot), the cost of this, between now and the declaration of peace, is not likely to equal the saving on first cost.

At the same time a reduction in current consumption is to be striven for whilst the difficulties in obtaining fuel are so great, and therefore the most efficient of lamps and apparatus should be installed when obtainable. Consumption has, fortunately, been much curtailed in the lighting department, owing to the police restrictions after the air raids, and the adoption of "daylight saving" in the summer time; otherwise, increasing demands for power purposes, synchronising with shortage of colliers and difficulties of transport, would have produced an even more serious situation. Not only coal, but other forms of fuel also are hard to obtain, and the contractor will think sorrowfully of certain country customers of his who paid in good, rich gold for sundry small generating sets driven, on his recommendation, by that now-forbidden luxury, petrol. In the case of fuel shortage, however, instead of looking backward to wood in place of coal, or water and wind to supply a more direct energy, we must look forward: not to large schemes of tide-driven or sun-driven dynamos which would take years to develop (we have no years to spare for that now), nor even to the utilisation of our moorland peat-beds, but to the linking-up of power stations and the elimination of the inefficient small and isolated plant. This is no "making do" with something worse for the time; it is the times making us do something better for the time to come.

To return to smaller things: some reversion to the "tree" system of wiring seems permissible at a time like this, for there is not the slightest doubt that it is very economical in the length of wire required. In steel-conduit work it is, of course, very difficult of application; but in the case of wood-casing or cleated wiring, many yards run of wire can usually be saved by tapping extra lights on to adjacent mains instead of carrying the leads back to distant distribution boards or looping-in points. By this means many short ends of wire, otherwise mere scrap, may be brought into useful service, especially for the small additions and alterations needed in ordinary maintenance work. The shorter pieces may be useful for tee-ing off mains, the larger ones for splicing into more useable lengths. If solder is scarce for this work (but it is hardly as bad as all that), it will be necessary to fall back on clamp connections; even in *absolutely* temporary jobs (so many temporary jobs become semi-permanent that they are danger-breeders) the dry joint is possible. The fire-insurance inspector, the supply authority engineer—these cannot be ignored; but if consulted beforehand, and with the case placed before them reasonably, there will be but few who will not stretch a point in the emergency. But—no return to early methods without early safeguards: if the tree system, then the local fuse; the one without the other is unthinkable.

The obsolescence of the arc lamp before the war prevented the upset that would have occurred a few years earlier owing to carbons being almost unobtainable in the first few months, but this trouble is now almost forgotten.

Another wire-saving device, now but little used, is that of the earth-return. There is no suggestion of a return to early practice in lighting work here, such as existed in utilising the stem of an electrolier or the ironwork of a ship in the primitive ages, but for bell work and telephone work there are many places where its adoption would be economical.

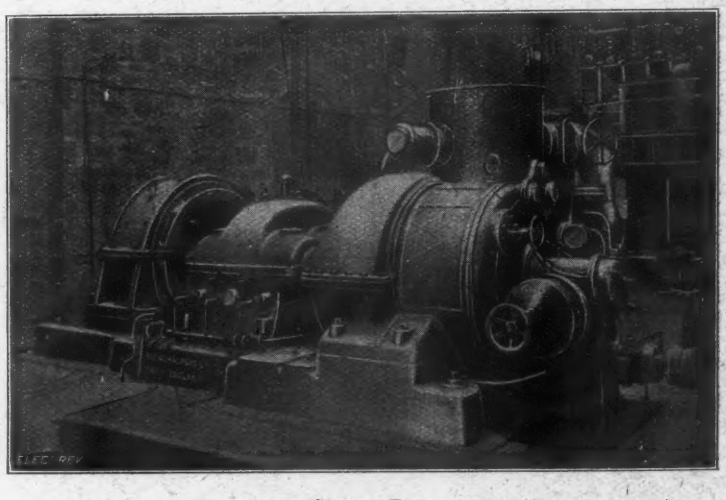
Simplicity in lamp fittings is imperative for the time, and the batten-holder presents this feature *in excelsis*. Failing that hermaphroditic combination of ceiling-rose and lampholder, some type of plain conduit, straight or bent on the job, is desirable; and in this connection the need for a stock lampholder, suitable for screwing direct on to ¾-in. conduit without the use of a reducing connector, is much felt.

There are many instances of "making do" which will occur to all—the use of metal shades in place of opal, of painted metal in place of enamelled ones, the painting instead of galvanising of other metal, the substitution of women for men (the *electricienne* has arrived, not only in the office, the showroom, and the battery-charging station, but in the realms of the wireman too). In some cases we are delighted with the new order of things, in others we just make them do for the time, and hope for the end of the time to come quickly. This way or that, by one means or another, we have gone on, we do go on, and we have every intention of going on till we can pick and choose once more and strive in the old strenuous way after perfection.

BO'NESS ELECTRICITY WORKS.

The Bo'ness electricity undertaking was started during 1904, when the generating plant consisted of two 100-kw. Davey, Paxman engines, coupled to Lancashire Dynamo Co.'s d.c. machines. Three years afterwards it was found necessary to provide additional plant; a Davey, Paxman-Lancashire Dynamo Co.'s 300-kw. set was then installed. During subsequent years the load has increased, so that at the start of the war the station was often loaded to the full capacity of 500 kw. Various temporary measures were suggested to deal with the increasing load, but eventually it was decided to put in a high-pressure turbine with an additional boiler and a separately fired superheater, and to fit mechanical stokers to the existing Heenan & Froude water-tube boilers. When the Secretary for Scotland was asked to grant the loan, he decided that the estimated expenditure would have to be reduced by £3,000 until after the war, and it was decided to delete the boiler and superheater, also the spare armature, and to put in Ferguson superheaters for the existing boilers.

The new plant, which consists of a 500-kw. Fraser and Chalmers high-pressure turbine, coupled to a Brush generator, was started up and put on test on April 25th, in the presence of Mr. J. M. M. Munro, the Council's consulting engineer, and Mr. F. E. Stanley, the chief engineer to the contractors, the National Electric Construction Co., who lease the station from the Council. This test was satisfactory in every way. The turbine runs at 4,000 r.p.m., and is guaranteed not to take more than 16·1 lb. of steam per kw.-hour at full load. The gear reduces this speed from 4,000 to 600 r.p.m., at which speed the generator is run. The latter is a compound-wound machine with interpoles, and is fitted with the Brush Co.'s latest commutator, which is designed to prevent the mica between the copper segments from rising. On test, the full-load efficiency of this machine was 94·8 per cent. The condensing plant was supplied by Messrs. Cole, Marchent and Morley, and consists of a contra-flow condenser, to which is



500-kw., d.c., Geared Turbo-generator.

coupled a Rees Roturbo rotary set, the rotary air pump taking its water from a connection on the salt-water circulating pump. The complete set is driven by one 49-H.P. motor at 2,000 R.P.M. The superheaters are of Messrs. Ferguson's standard type, and the chain-grate stokers were supplied by Messrs. Babcock & Wilcox. A part of the scheme was the laying of two ·60 L.S. and S.T. cables to a distant part of the town. The work was chiefly done by women, and, we believe, was the first instance of the employment of females on this class of work.

The installation has been carried out under the supervision of Mr. H. C. Babb, the engineer and manager.

THE SIMPLIFICATION OF LINE TESTING.

BY GEO. F. TANNER, A.M.I.E.E.

[THE following useful note appears in the current issue of the *Post Office Engineers' Journal*. The author informs us that the method is universally applicable; it is independent of assumed constants and corrections; it is equally of value to the mains engineer in dealing with an earth fault on a twin conductor, and D may be in as low a unit as yards with equal accuracy.]

In every case where a Varley loop test is made, the question which at once arises to the orthodox is, "what is the weight per mile of the conductor under test?" In the generality of cases, as, for instance, in testing over a paper cable where the conductors are of the same gauge, or where it is possible to obtain similar conductors, this knowledge is not only unnecessary, but frequently contributes to a less accurate result.

There is no originality about the following method, yet, as it appears to be seldom used, it is perhaps excusable to bring it under notice.

Provided the conductors comprising the loop under test are of the same gauge, the only known factor required is the distance between the two testing points.

Assuming the conditions of the ordinary Wheatstone bridge test for an earth fault, then calling the result of the resistance of loop test, London to Birmingham, L, and result of distance test l, and distance to Birmingham D miles, the distance of fault in miles—

$$= D \times l/\tfrac{1}{2} L \text{ or } 2D \times l/L.$$

That is, the result of the first test divided by the result of the second test, multiplied by twice the distance over which the test is made, gives the distance of the fault in miles.

It will be seen that the result of expressing the distance of the fault as a fraction of the loop itself is to fractionise all inaccuracies due to slight variations in weight per individual mile. It is independent of temperature correction also. The method produces a truer result than by slavishly working out the problem on a resistance-per-mile basis.

It came under the writer's notice that the weight-per-mile principle was not quite good enough, as manufacturers not infrequently supply slightly more copper than the specification calls for. In short, without going into details, variations do occur from various causes in actual practice. A method was, therefore, sought to combat this source of error, and the foregoing suggested itself. I may add that its application has yielded more successful results in practice than the older and more general method; it also has the advantage of being much simpler.

Thawing Water Pipes by Electricity.—During the past winter a petrol motor wagon was put to a somewhat novel use at Spokane, U.S.A., by the Water Department of that city—that of thawing the public water mains, which had become frozen up owing to the excessive cold. Mounted on the platform of the wagon is a 40-H.P. petrol engine coupled up to a 300-ampere, 60-volt generator, the current from which is conveyed to the water pipes by a ½-in. flexible conductor. It is stated that the machine has given most satisfactory results, and has done away with the steam thawing arrangement previously employed, at the same time rendering the water authorities independent of the electricity supply companies' mains, which were not always available for water pipe thawing purposes.

IMPROVEMENTS IN MAGNETIC IRON ALLOYS.

(From *Génie Civil*: Abstract.)

IT is not generally realised how great is the potential saving or waste in annual expense associated with the quality of the materials used in electrical machinery, and, in particular, with the magnetic quality of the iron. Formerly it was thought that the magnetic properties of iron depended simply on its degree of purity, and Swedish charcoal-iron was the standard of excellence. A new era began with Sir Robert Hadfield's discovery that a small proportion of silicon or aluminium improved the magnetic properties of iron. Even ½ per cent. increase in the efficiency of a 5,000-KW. transformer, due to reduced iron losses, represents 25 KW. increase in output, and (with energy at ½d. a unit) an annual saving of £456. It is estimated that the saving due to improvements in the magnetic quality of iron since 1889 exceeds £2,000,000 per annum in the United States alone. The principal stages in recent progress are summarised in Table I, page 540.

Until 1910, 21 years after Hadfield's "key" discovery, the maximum permeability did not exceed 8,350. Then a notable advance was effected by Terry's experiments with electrolytic iron, and, yet more recently, Yensen (Illinois), has attained still more remarkable results by thermal treatment *in vacuo*.* So far as Yensen's experiments concern electrolytic iron, they have no immediate application in practice, because it is not yet feasible to produce electrolytic iron in bulk. It appears, however, that commercial iron, treated *in vacuo*, acquires magnetic properties far superior to any hitherto at the disposal of the electrical designer. Directly the vacuum treatment can be accomplished on an industrial scale iron losses will be, roughly, divided by five, and the annual saving in the 5,000-KW. transformer mentioned above would be £4,560 per annum. The significance of such possibilities in connection with the better utilisation of materials, and the cheapening and more extensive use of electricity supply, needs no emphasis.

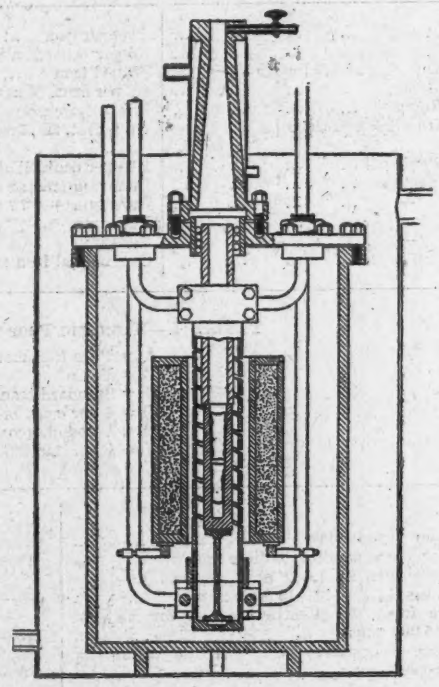


FIG. 1.—SECTION OF ARSEM FURNACE FOR HEATING IRON IN VACUO.

Increased permeability permits the use of a lighter and cheaper magnetic circuit for a given flux—*i.e.*, for a given machine output. Eddy-current losses are small in comparison with hysteresis losses, but it is worth while to reduce them by using high-resistance material in thin sheets. The mechanical and thermal treatment of iron has little influence on its electrical resistance, and in practice it is only necessary to consider its chemical composition. Hysteresis losses diminish with temperature for constant H, but in practice $B_{max.}$ must be kept as nearly as possible constant, hence the hysteresis losses increase with temperature.

Experience shows that maximum permeability in iron corresponds to minimum hysteresis losses. Also, many of the conditions for high mechanical strength are also conditions for high permeability. For instance, any material of lower permeability than pure iron, and especially air or gas inclusions, reduces the permeability of the sample, and also reduces its mechanical strength. The crystalline structure is also a matter of importance, the mag-

* See ELECTRICAL REVIEW, April 14th, 1916.

netisation of iron crystals not being the same in all directions. Large crystals and low reluctance are desirable.

The purest iron is that obtained electrolytically. On an industrial scale, iron containing C, 0·004 ; S, 0·006 ; Si, 0·007 ; and P, 0·008 per cent. has been obtained from a cast containing C, 2·35 ; S, 0·07 ; Si, 1·31 ; P, 1·07 per cent. By using electrolytic iron, the utilisation of material in transformers is increased by 33 to 40 per cent. ; in A.C. motors, the output is increased 50 per cent. for equal size and temperature ; in D.C. motors, 16 per cent. reduction may be effected in the weight of active iron. Yensen's specimens of electrolytic iron, which were yet further improved by treatment *in vacuo*, were prepared as follows :—The electrolytic deposit was crushed, chemically purified, dried *in vacuo*, and then placed in a magnesia crucible in an Arsem vacuum furnace (fig. 1), where the metal was melted under a pressure of 0·5 mm. mercury. Thus prepared, the iron contained no trace of oxide, and less than 0·01 per cent. of carbon and of silicon. The treatment *in vacuo* more than doubled the permeability of the iron, and reduced the hysteresis losses in the same ratio.

Carbon has an unfavourable effect on the magnetisation curve and on the hysteresis losses ; it is very difficult to eliminate completely, but is less injurious in the form of graphite than in combination. Pearlite (Fe_3C) and cementite (Fe_3C) are magnetically inferior to ferrite (pure iron). *Boron* exerts a somewhat similar effect to that of carbon on the magnetic and mechanical properties of iron-cobalt alloy and of pure iron are compared in Table II.

Aluminium, being non-magnetic, may only be used in small quantities, not exceeding 0·1 per cent. ; its effect is then useful.

Influence of Chemical Composition on Magnetic Properties.—The properties of ferro-silicon alloys have been investigated extensively by chemists, metallurgists, and physicists since Sir Robert Hadfield first discovered the superiority of some of these alloys for electrotechnical applications. The addition of silicon reduces hysteresis losses and increases permeability, the effect commencing at about 2 per cent. silicon, and continuing to the limit at which forging becomes impracticable (about 7 per cent. Si). The action is due not to the direct influence of the silicon (which reduces the intensity of magnetisation at saturation), but to neutralisation of the effect of carbon. The carbon in a ferro-silicon alloy, though present to the extent of 3 or 4 per cent. or more, is neither combined nor in solution, but is entirely in the form of graphite, which is the least injurious form, so far as concerns magnetic properties.

From Yensen's investigations on 33 alloys containing from 0·068 per cent. to 4·39 per cent. Si, and about 0·01 per cent. carbon, with oxygen as the only impurity, it appears that silicon first reduces the oxide of iron, before combining with the iron. In this respect it differs from carbon but resembles boron, although the oxidising effect of the latter is more energetic. On plotting the magnetic

TABLE I.—Recent Progress in Electrical Irons.

Year and investigator.	Material tested.	Maximum permeability.	Coercive force in gilberts per cm. for		Hysteresis loss, ergs per cb. cm. per cycle for	
			B_{max} = 10,000 gauss.	B_{max} = 15,000 gauss.	B_{max} = 10,000 gauss.	B_{max} = 15,000 gauss.
1900—Hadfield	Swedish iron	4,000	0·92	1·0	2,700	5,500
1900—Hadfield	2·5 per cent. Si alloy	5,100	0·72	0·79	2,200	4,700
1901—Gumlich and Schmidt	Forged iron	8,350	—	0·6	—	—
1903—Baker	4·9 per cent. Si alloy	—	—	1·2	—	6,200
1910—Terry	Electrolytic iron	11,000	—	—	—	—
1912—Gumlich and Goerens	4 per cent. Si plate	11,600	—	0·54	—	—
1912— " "	" "	9,400	—	—	—	—
1912—Paglianti	1·75 per cent. Si alloy	—	0·6	0·75	1,650	3,500
1913—Yensen	Pure iron treated *in vacuo*	19,000	—	0·29	813	1,640
1915— —	Pure iron + 0·15 per cent. Si... ...	66,500	0·09	0·16	286	916
1915— —	Pure iron + 3·4 per cent. Si... ...	63,300	0·08	0·15	282	1,025
1916— —	Pure iron + 3 per cent. Si... ...	72,000	0·09	0·16	254	926
1916— —	Commercial iron treated *in vacuo* ...	20,900	0·30	0·34	865	1,760

TABLE II.—Magnetic Properties of Iron-cobalt Alloy and Pure Iron.

A = Pure iron melted *in vacuo**
B = Fe_2Co*
C = Standard transformer steel†
D = 4 per cent. Si-steel†
E = Wood charcoal Swedish iron*
F = Pure iron melted *in vacuo*‡
G = Fe_2Co‡
} Commercial irons.

	A	B	C	D	E	F	G
Maximum permeability	22,800	13,200	3,850	3,400	4,850	24,300	8,800
Induction corresponding to ditto (gauss)	10,000	8,000	7,000	4,000	6,500	8,500	8,000
Hysteresis loss, in 1,000 ergs per cm. cube per cycle for B_{max} = 10—15,000 gauss	0·8—1·7	1·5—3·2	3·3—5·9	2·3—3·0	2·5—4·5	0·7—1·7	2·2—4·4
Coercive force, in gilberts per cm. for B_{max} = 10—15,000 gauss	·27—·33	·48—·65	1·2—1·33	·88	·88—·95	·22—·26	·75—1·0
Remanent magnetism, in 1,000 gauss for B_{max} = 10—15,000 gauss	9·3—14	9·1—12	7·7—9·9	5·4	6·9—8·0	9·3—13	9·3—12·3

* Annealed at 900° C. † Subjected to standard industrial treatment. ‡ Annealed at 1,100° C.

properties of iron. If a small percentage of boron be added to iron melted *in vacuo*, part of the boron reduces iron oxide and improves the magnetic properties, but the rest combines with the iron and produces an opposite effect. The presence of boron is tolerable up to 0·05 per cent. ; it increases the electrical resistance by about 0·62 microhm-cm. per 0·01 per cent. of combined boron. There is still a difference of opinion as to the exact effect of *sulphur* and *phosphorus* on magnetic properties, but it is certain that more than 0·03 per cent. of these elements produces bad results ; and, in view of their detrimental influence on mechanical properties, it is desirable to eliminate them as completely as possible.

Quite unexpected results have been obtained with the *iron-cobalt alloy* Fe_2Co. Its magnetic properties are distinctly superior to those of pure iron, the gain in saturation density being 10 to 13 per cent. With fields between 50 and 200 gilberts per cm. the magnetisation of the alloy is about 25 per cent. greater than that of iron ; it is lower than that of iron only for fields below 7·5 gilberts per cm. The hysteresis losses of Fe_2Co are considerably below those of the best transformer irons for inductions below 10,000 gauss, and nearly equal to them for inductions above 15,000 gauss. The alloy is brittle, but has the same tensile strength as pure iron when both are annealed, and twice as great tensile strength in other cases ; in order that it may be used advantageously in field cores or the like, it is necessary to cheapen its production, and to reduce its fragility by further alloying. The magnetic properties of this series of alloys against the percentage of silicon, there are seen to be two maxima in the curve of maximum permeability, corresponding to two minima in the curves of hysteresis loss and coercive force. The first of these corresponds to 0·15 per cent. Si, and the second to 3·5 per cent. Si as regards maximum permeability, or to 4 per cent. Si as regards minimum hysteresis loss. The discrepancy between the Si contents corresponding to the second permeability maximum and hysteresis minimum is due to the hysteresis loss depending much more on the coercive force than the permeability. The existence of a marked permeability maximum and hysteresis minimum with a very small silicon content is, doubtless, due to the silicon eliminating the traces of iron oxide previously present. In other words, the result is due to purifying the iron, and not to the formation of an alloy. The quantity of silicon necessary for this purpose varies with the amount of oxide in the iron, and regular variation of magnetic properties with percentage of silicon can only be expected after the iron oxide has been eliminated. Formerly the good magnetic qualities of 2·5 to 4 per cent. Si alloys were attributed solely to conversion of the combined carbon to graphite, but Yensen's iron, containing only 0·01 per cent. of carbon, could not require anything like 3 or 4 per cent. of silicon to neutralise it, hence we are driven to the conclusion that the second permeability-maximum and hysteresis-minimum mentioned above is due to no direct action of silicon, but to its combination with iron.

The purity of the iron used in preparing a ferro-silicon alloy is

most important. For instance, the permeability of a 3·4 per cent. Si alloy using electrolytic iron melted *in vacuo*, is about 20 times as great (at 6,000-7,000 gauss) as that of a similar alloy using commercial steel. For a maximum induction of 10,000 gauss, the hysteresis loss is eight times as great; and for 15,000 gauss, three times as great in the commercial alloy as in the pure iron-alloy. The electrical resistance is practically the same in both cases, and is about five times greater than that of pure iron.

Of two pure iron-alloys, one containing 0·05 per cent. and the other 4·44 per cent. Si, giving equal hysteresis losses with a maximum induction of 10,000 gauss, the high-silicon alloy is characterised by low remanent magnetisation and maximum permeability to low flux densities, whereas the low-silicon alloy has very high remanent magnetism and great permeability at high and medium flux densities. Silicon, itself indifferent from the magnetic standpoint, diminishes permeability in the first case, but in the second case it plays the part of a molecular lubricant diminishing the friction which opposes orientation of the molecules in the magnetic field. The fusion *in vacuo* method has furnished two alloys, one with a low-silicon content, hard, ductile, of high permeability, low hysteresis loss and low resistance, suitable for dynamo plates; the other with high-silicon content, hard, moderately strong, of high permeability, low hysteresis loss and high resistance, suitable for transformer plates. The properties of these alloys are summarised in Table III.:—

TABLE III.—The Two Best Vacuum-Melted Ferro-Silicons.

Silicon content (per cent.)	0·15	3·4
Tensile yield point (lb. per sq. in.)	19,800	57,800
Breaking strength (lb. per sq. in.)	36,700	76,000
Extension (per cent.)	56	21
Reduction in area (per cent.)	90	28·5
Maximum permeability...	66,500	63,300
Induction corresponding thereto (gauss) ...	6,500	6,500
Hysteresis loss (ergs per cm. cube per cycle):		
B_{max} = 10,000 gauss...	286	280
B_{max} = 15,000 gauss...	916	1,025
Resistivity (microhms-cm.).	11·8	48·5

Diverse opinions are held as to the effect of Si in the presence of other elements in iron alloys, probably owing to the different methods employed by various investigators and the different conditions under which tests have been made. Marenine published, last summer, the results of tests made in the Technological Institute of Petrograd, from which it appears that the action of Si in the more complex alloys is analogous to its effect in ferro-silicon. According to this investigator, the chemical composition of plates used for electrotechnical purposes should be:—C, not more than 0·08 to 0·1 per cent.; Mn, 0·1 to 0·3 per cent.; Al, not over 0·1 per cent.; S and P, traces; Ni and Cu, less than 0·05 per cent.; Co, probably desirable in large quantities; Si, 0·5 to 0·7 per cent. for dynamos, 3·5 to 4·5 per cent. for transformers.

Mechanical Treatment.—Ingot iron has normally a coarse crystalline structure, but, during subsequent mechanical treatment, these crystals are crushed and intermingled. The longer the mechanical treatment, and the lower the temperature at which it is given, the more profound the changes in the crystalline structure. The iron is rendered more or less amorphous, and the magnetic properties are affected adversely. Similarly, iron subjected to repeated blows (even if only light), suffers in magnetic quality.

Heat Treatment.—The ill-effects of mechanical treatment may be corrected by annealing at about 1,000° C., followed by gradual cooling. The result of such treatment is to eliminate internal strain set up by mechanical treatment, and to induce the formation of large crystals. For best results the annealing must be continued long enough, and the cooling must be gradual enough, for all the desired changes in structure to be effected. There are great possibilities in combined thermal and magnetic treatment, such, for instance, as cooling the annealed iron in an alternating field. When the iron passes from the β to the α state, its particles are momentarily polarised, and as much as 50 per cent. increase may be obtained in the maximum permeability. This treatment, however, is not yet beyond the laboratory stage.

The well-known *ageing* of transformer plates, by which their losses are materially increased, is more rapid the higher the working temperature. The phenomenon is due to changes in crystalline structure, the stability of which varies with chemical composition. The structure of ferro-silicon and electrolytic iron is so stable that deterioration by ageing is very gradual.

Melting in vacuo.—The possibilities of this process are certainly immense, but it is not possible to foresee their exact scope. Electrolytic iron is not yet available on a commercial scale, but, as shown by Table I, commercial iron treated *in vacuo* has magnetic properties superior to those of electrolytic iron, so that the more urgent desideratum is to develop electric vacuum furnaces on an industrial scale.

Yensen finds that samples of purest commercial steel, re-melted *in vacuo*, annealed at 1,100° C. and cooled at the rate of 30° C. per hour, are given two or three times their former maximum permeability by this treatment; at the same time, the hysteresis losses are reduced. Chemical analysis shows no change in the composition of the metal, but micrographic examination shows the crystalline structure to be much larger in the iron which has been treated *in vacuo*. Also, this metal is free from the tiny cavities caused by gases in the commercial iron. Further investigations are needed urgently, since there are possibilities of immense annual saving by reducing the iron losses of electrical machinery and apparatus of all kinds.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Ironclad Switch.

We have received from Messrs. S. Bill & Co., Ltd., of Queen's Road, Aston, Birmingham, a sample of their new pattern ironclad 60-ampere double-pole switch, with side handle and interlocked lid, to comply with the Home Office rules.

The switch, which we illustrate in fig. 1, is of substantial design, with a separate porcelain interior for each pole, the terminals being shielded by porcelain partitions. A special feature is the cranked

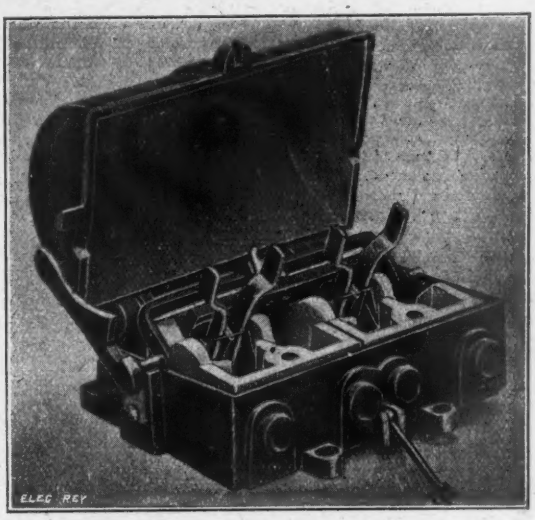


Fig. 1.—D.P. Ironclad Switch with Side Handle.

spindle of the lever handle which is attached by a loose coupling to the coupling bar of the switch blades, this arrangement getting over the trouble arising from the different thicknesses of china bases which it is impossible to avoid in manufacturing, and which would otherwise disturb the alignment of the lever spindle. The arrangement is, we understand, provisionally patented. This type of switch is supplied with either solid or laminated blades; the brass and copper work is substantial and the connecting leads are led in through bushed holes direct into the terminals which have double screws. Fixing lugs are provided to the case, and a bolt and wing-nut secures the lid.

Magnetic Chuck Switch.

Messrs. Donovan & Co., of 47, Cornwall Street, Birmingham, inform us that they have recently introduced a new type of switch for rapidly and conveniently energising and de-energising magnetic chucks. The necessity for such a switch has long been realised by manufacturers who use magnetic chucks on their machines, and the switch in question has been introduced with a view to making the operation as simple and rapid as possible. When operating the switch an arm is pushed on to the "on" position, which energises the chuck, and it remains in that position until it is desired to de-energise, when the handle is pushed in the opposite direction to the reverse position, and as soon as it is released by the operator it automatically returns to the "off" position. These switches have been throughly tested by manufacturers in practical use, and have been found to be perfectly satisfactory, and a great improvement upon the former practice. The makers will send illustrations and a full description of these switches upon application.

LEGAL.

Munitions Court Cases.

At the Bradford Munitions Tribunal 10 employés of a dynamo manufacturing company were charged with failing to work regularly. Two of them had been released from the fighting line to take part in urgent aeroplane work, and, at their special request, had been allowed a day and-a-half extra holiday at Easter. The main reason for the prosecution was that similar liberties were taken after the Christmas holiday. The offence of all the men was the same. The Admiralty were pressing urgently for completion of orders, and this was impossible if men absented themselves for days and half-days without very good reason. This was the first time the firm had prosecuted for time-breaking, and they did it

now with regret. One man's defence was that his wife was ill. Other men said that they had been away to Weymouth, Mid-Cornwall and Devon, and had been unable to get back in time. Two apprentices admitted that they had left work because others had done so. It was mentioned that the other apprentices in this business had submitted themselves to the works tribunal and been fined 1s. each. The Chairman of the Tribunal said the importance of this prosecution was obvious to anybody. The work of these men was of the greatest possible urgency in the national interest. He warned the offenders that further offences would be very severely dealt with. One man was fined 40s., four were fined 20s. each, two 10s. each, and the two apprentices 1s. each. One case was withdrawn.

At the Nottingham Munitions Tribunal Court, an emergency driver in the service of the Nottingham Corporation Tramways, applied for a leaving certificate, on the ground that he was dissatisfied with his wages and could obtain work of a character more useful to the country. He already had a situation offered him. Mr. J. Aldworth, the manager of the tramway undertaking, explained that it was certified as being necessary for munition workers. Applicant entered the service last year, and was trained to drive. The man's earnings, with the bonus, during the past 13 weeks, had averaged £2 6s. 9d., including one week of four days. He drove one of the cars for munition workers, and it was impossible to replace him. The Tribunal granted the certificate, believing that the work he proposed to undertake was of greater national value than that in which he was engaged at present.

BRITISH THOMSON-HOUSTON CO., LTD., *v.* CORONA LAMP WORKS, LTD.

MR. WALTER, K.C., on May 10th, laid before Mr. Justice Younger in the Chancery Division a motion for an injunction in this patent action.

He stated, however, that the matter was not one that could be satisfactorily dealt with on motion, and, following a precedent of a case before the Court of Appeal, he had arranged with Mr. Kerley, K.C., who appeared on the other side, that there should be no order upon the motion, except that the costs should be costs in the cause, the defendants undertaking until the triál to keep an account.

MR. KERBY stated that this was the great Half-watt lamp case, and that there would be a full-dress debate later.

His LORDSHIP assented to that course being adopted.

GRUBAN *v.* BOOTH.

ON Monday last the hearing of this case, which had occupied the attention of Mr. Justice Coleridge and a special jury in the King's Bench Division for some days, was concluded, the jury awarding plaintiff £4,750 damages. The plaintiff was Mr. J. G. W. Gruban, of East Molesey, who came to this country in 1893 from Saxony, and was naturalised after the outbreak of war. He was managing director of Messrs. Haigh, Gruban & Co., Ltd., tool makers, of Oldham, into which business he put £10,000. The defendant was Mr. F. Handel Booth, M.P., whom Mr. Gruban introduced to the business as a co-director in 1915. Plaintiff claimed damages for alleged fraud, stating that defendant represented that he held the authority of the Ministry of Munitions and other officials for stating that the plaintiff would be interned unless he handed over his position and property to defendant, who agreed to be trustee for the plaintiff. Though plaintiff agreed to defendant's proposal, he was interned a week later. Subsequently the Advisory Committee inquired into the matter, and plaintiff was liberated. Mr. Booth denied that any such agreement as referred to, was made, and repudiated liability.

The questions put to the jury after Mr. Justice Coleridge had summed up, and their replies to same, were as follows :—

1. Did the defendant falsely and fraudulently represent to plaintiff that he (the defendant) was in a position to protect plaintiff from attacks if plaintiff obtained for him the appointment of chairman of the company?—Yes.

2. Did the defendant falsely and fraudulently represent that he had been informed by the Minister of Munitions (Dr. Addison) that plaintiff would be interned unless he resigned?—Yes.

3. Did defendant maliciously, and without reasonable and probable cause, cause the plaintiff to be interned?—No.

The damages awarded on question 1 were £2,250, and on question 2, £2,500—total, £4,750.

WAR ITEMS.

Trading with the Enemy.—The "London Gazette" for May 11th contains further lists of persons and bodies in the following countries with whom trading is prohibited :—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Columbia, Netherlands, Netherland East Indies, Norway, Spain, Sweden, &c.

For Our Blinded Heroes.—We have received a copy of the report of St. Dunstan's Hostel for Blinded Soldiers and Sailors for the past year. Few of the beneficent efforts following upon the horrors of war make so pathetic an appeal as does that on behalf of the man for whom everything is so greatly changed because he had laid upon the altar of the Allied cause that priceless treasure, the sight of his eyes. At St. Dunstan's, Regent's Park, there are 354 blind inmates, and accommodation is now extended so as to double that number. The men learn to live new lives, are taught new ways of doing old things, learn useful occupations, and so on, amid surroundings which are designed to make life as happy and bright as possible. The familiar fate of blind leaders of the blind does not find fulfilment here, for in the workshops the instruction is mainly given by men who are themselves blind. The whole story is a very fascinating and very touching one, and we are sure that the generous-hearted who have it in their power to support so splendid an object will not turn a deaf ear to the appeal for subscriptions and donations. These may be sent addressed to the Secretary at the Hostel, as above.

Female Labour at Bristol.—The military necessities have made big demands on the staff of the electricity undertaking at Bristol, so that, as in the case of similar undertakings, the substitution of female labour for those members of the staff and employés who could be released for military service has been resorted to. The training of women for rotary substation work has been looked upon with some trepidation owing to Bristol's multiplicity of systems, but it is hoped that they may be found suitable for this work also. Female labour has been introduced into the laboratory, generating station, meter department, and sales department. In addition, the depletion of the general office staff has been filled by members of the female sex. The following tabulation shows Bristol's record in this direction prior to and since the war :—

	At present.	Prior to war.
Switchboard operators in training ...	8	..... —
Cleaners at generating station ...	9	..... —
Meter readers	7	..... —
Sales department (showrooms) ...	2	..... —
Clerks and stenographers	26	 1
Laboratory assistant	1	..... —

Exemption Applications.—Before the Somerset Appeal Court, exemption was claimed by the Taunton Electric Traction, Co., Ltd., for Mr. V. L. Marshall (33, in Class A), acting tramway manager and traffic inspector, taking the place of the regular manager whilst in the Army. Mr. Marshall was appointed because he was medically rejected, and on April 20th his conditional exemption was cancelled by the Taunton Tribunal. It was claimed that he was not fit for general service, and that he was doing practically three men's work, and had liberated five men for service. The Court dismissed the appeal, but allowed an appeal to the Central Tribunal.

At Colchester, the borough electrical engineer appealed for the retention of F. E. Rodwell (32), stoker at the electricity works, and stated that the demand for power was now greater than ever, and that it had been found impossible to secure a substitute. The Tribunal decided that the time had arrived when a substitute should be found, and they respited the appeal for a month with this in view.

Barnstaple Tribunal, on May 9th, considered a Military appeal against exemption held by M. Y. Andrew (18, in Class B 1), premium pupil at the Corporation electricity works. The manager said that the conditions imposed when exemption was granted were being observed. The Military Representative (Mr. H. P. Woodcock) said that he believed that some instructions had been issued to electric light stations that women could be employed on the switchboards, and asked if any attempt had been made to train anyone else so that Andrew could be released. Mr. Hadfield (the manager) replied that he had been training this man for 18 months, and the Chairman of the Electric Light Committee (Ald. H. Barrett) said that if the Military could supply them with a competent substitute the man could go, but Mr. Hadfield could not devote the necessary time to training anyone else. Mr. Woodcock said it was not for the Military to supply a substitute, and added that he knew of one switchboard attendant who had applied to the Labour Exchange for a post, and they had none for him. Mr. Hadfield observed that he believed the man referred to picked up his knowledge of electricity, and he would require capable supervision, which he had not the time to devote. The application was refused, and the exemption confirmed, and the Military gave notice of appeal.

At Worcester, Messrs. J. Ward, Ltd., appealed for the retention of A. E. Shrimpton (39), electrical engineer, who has the oversight of work at a number of controlled and munition factories. The Tribunal conceded conditional exemption.

At Carlisle, on May 9th, the city electrical engineer (Mr. Purse) appealed for R. Boyle, a handyman at the works, discharged as medically unfit from the R.F.A. in 1914. Conditional exemption was conceded.

Twenty employés were appealed for at Houghton-le-Spring by the Sunderland District Tramway Co. Mr. G. Stratton stated that several of the men were on the repair staff, and they found it very difficult to keep a sufficiency of cars running owing to the lack of qualified men; 129 employés had joined the Forces. The Tribunal granted six months' exemption, on the understanding that if opportunity offered substitutes would be engaged.

Sheffield Tribunal has granted exemption until the end of July to S. Gray, electrical engineer, appealed for by Messrs. J. Booth & Co., who is in Class C 3.

Before the Surrey Appeal Court, the Military Representative appealed against conditional exemption held by Mr. T.

Hill (37, in Class B 1), electrical engineer, of Farnham. The appeal was upheld, and three months' exemption substituted.

The Surrey Appeal Court has granted three months' exemption to Mr. W. E. Baker (34, in Class C 1), electrical engineer, of Ashtead.

An appeal was made to the Sussex Tribunal by an electrical engineer at Burgess Hill for himself and a motor attendant. He stated that he contracted for the supply of electricity for lighting at Burgess Hill, and ran the plant at several munition factories. He had lost 35 men, and his present staff consisted of 19 women, men, and lads. The employer was given three months' conditional exemption, and the other appeal was rejected.

At Bexhill-on-Sea, Mr. R. W. Waine appealed for J. Bloor (36, in Class B 1), electrician, the only man left in two shops. Three months were given on the man joining Section B of the Volunteers.

Before the Hants Appeal Court, Mr. F. Bruce Holt (32, passed for general service), electrician, Ryde, appealed as owner of a one-man business. He stated that he had lighting installations to complete. His last man had been taken, and he now had only the assistance of a boy and girl. His business, the only one of its kind in the town, would have to close if he went. The appeal was disallowed.

At Woodbridge (Suffolk), further exemption for their electrical engineer was applied for by the Electric Light Co., who stated that the engineer had charge of the works at Woodbridge and Orford. Three months, with leave to appeal again, were granted, and an appeal was threatened by the Military Representative.

Bath Tribunal has, on the appeal of the Military, withdrawn conditional exemption held by G. N. Shipp (22, in Class B 1), stoker at the works of the Bath Electric Tramways, Ltd.

At Oxford, the Military appealed against conditional exemption granted on September 14th last to A. Greenaway (33, passed for general service), electrical fitter to Messrs. Barlow & Alden. Exemption cancelled, with a month's grace.

Salisbury Tribunal has given exemption until September 1st to an engine driver and electrician, in Class B 1, applied for by the Electric Light Co., whose manager stated that it was impossible to obtain another man.

Hitchin Rural Tribunal has granted three months' exemption to A. Edwards (30, in Class C 3), electrician at Lilley Manor, applied for by Mrs. Sowerby.

At the Shoreditch Tribunal, Mr. James Hind, of 6, Eldon Street, E.C., electrical and general merchant, made a second application on business grounds. He said he had a turnover of about £45,000 a year, and dealt chiefly in small electrical articles, such as torches, &c., which he got from Switzerland. His trade had been proved to be satisfactory to the Government, as they had granted him permission to import a number of prohibited articles. His profit was a little over £1,000 a year, but he explained that mostly he sent the orders abroad, and they sent direct to the customer. Despite this, however, he carried stock worth £4,000. A member said it was clearly a factoring business. Applicant was granted four months, V.T.C.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wiring with Tough Rubber Compound Cables.

Seeing that several letters have appeared in your "Correspondence" columns since the publication of the article "Wiring with Tough Rubber Compound Cables," I venture to seek space in which to briefly reply to the points raised.

The letter in your issue of May 4th, page 493, signed by "Another Member of the E.C.A.," is much appreciated. In the first paragraph he deals with the attitude of "fire insurance companies" in respect of the adoption of C.T.S. cables. I attribute this to their usual sluggishness. They are always slow in recognising new methods.

The suggestion to use light conduit in plaster for runs to switches is, no doubt, a good one where alterations are likely to be required, but for many situations it is quite unnecessary.

There is certainly room for a good type of joint-box, as your correspondent suggests, although I have not had any trouble with the existing designs. With a little scheming it is possible to dispense with joint boxes by employing multiplate ceiling roses, which fulfil the requirements stipulated, being fireproof, and having ample terminal accommodation.

As regards the sun's influence, there is no doubt that the surface of any kind of rubber is affected to a certain extent, but so long as the makers know that a C.T.S. cable is to be used in strong sunlight, they can always treat it in such a way as to prevent even the superficial cracking mentioned in the letter under consideration.

I should be pleased to give information of the nature suggested, but could not do so in the space at my disposal, as the uses of C.T.S. in various situations would require to be dealt with at length.

Certainly the methods of switching and details of circuits could be applied to other "wiring systems." The object of including them was to conform with the wishes of many contractors, and also to demonstrate how the twin cable and triple cable simplified the wiring.

With regard to the letter written from the "Consumers' Engineer's" dugout, I am sure that "Another Member of the E.C.A.," in addition to myself, will not object to your correspondent's claim to possess a wider perspective than our humble selves, particularly when it becomes so blurred as to miss the vital points. I also admit that if all supply authorities' representatives were like "Consumers' Engineer" it would be a hopeless task to attempt to instruct them on new methods. As a matter of fact, although I quoted only three instances to demonstrate the little knowledge possessed by *some* supply representatives of C.T.S. cables, if space permitted I could instance a score more.

Continuing, he states that in advocating any system, the first essential is varied experience; just so, hence the article.

With regard to trifling with the intelligence of your readers *re* the watertight system (I always avoid the use of the term "permanent"), I have sufficient confidence in their experience and memory to venture to quote the well-known Mr. D. S. Munro, M.I.E.E., who recommended the use of C.T.S. cables with conduit boxes as far back as 1913.

I will pass over the misread suggestions of "Another Member, &c.," and the allusion to "poultry" in order to reach the concluding paragraph. My 18 years' experience in the electrical contracting industry brings me to heartily endorse the two concluding lines.

In conclusion, I venture to allude to the letter from Messrs. A. P. Lundberg & Sons. Seeing that they are specialists, I appreciate their interest. I do not agree that the tumbler switch has a marked superiority over the turn pattern for several reasons. In the "Diamond H switch" we have a very rapid and long break. It has "four positions," whereas I do not know of a tumbler switch that has more than "three," and for this reason there is one control, that of the "billiard room," which could not be controlled by one tumbler switch. The turn pattern can be used on "600 volts," and is used on many railway systems, especially where shops are supplied with current from the system at 600 volts. The turn pattern can be obtained up to 40 amperes capacity.

As to the American names being more or less meaningless, if we consider the definition of the term "point" in the I.E.E. Rules, and then deal with the two-point switch, the title seems appropriate. One turn of the switch closes the circuit to one pair of terminals (or point), a second turn closes the circuit, at another pair of terminals or point in addition, a third turn disconnects at the first point, leaving the second point still on, a fourth turn switches all off.

Apologising for the length of this reply, and thanking you for your assistance,

W. Ellerd-Styles.

London, E.C., *May 14th*, 1917.

Both Mr. Ellerd-Styles and "Another Member of the E.C.A." appear to have emphasised the critical point regarding C.T.S. cables, viz., the price. It is difficult to believe that the difference between the cost of the sheathing and the cost of taping and braiding is so great as to make the finished "cab tire" cable roughly twice as dear as C.M.A. taped and braided V.I.R. cable.

From a contractor's point of view C.T.S. is an interesting proposition, but it is hard to convince a customer that he should pay as much or more for a C.T.S. job than a screwed-tube one. It does not look reasonable. Of course, I refer to an ordinary installation, and not one where corrosion troubles have to be guarded against, for in the latter case the advantages of C.T.S. are obvious.

If, however, the makers insist that the price is justified, I would say why only make the cable in C.M.A. grade? Why not in N.A.? How many installations are carried out in C.M.A. compared with N.A.? An extremely small percentage.

In any case, it seems to me that the makers are likely to miss their opportunity if they maintain their present policy. It is a case of killing the goose that lays the golden eggs.

Practical.

As "Consumers' Engineer" suggests in his communication published by you last week, no doubt your readers welcome "the views of one with a wider perspective"; in fact, as the writer of the letter which you kindly inserted in your previous issue, signed "Another Member of the E.C.A.," I may say that it was with this very object that I ventured comment upon Mr. W. Ellerd-Styles's article.

Without doubting for one moment "Consumers' Engineer's" "wider perspective," I cannot help wondering on what grounds he bases his comparison. I certainly have only been an installation engineer for about 20 years, but I understood that Mr. W. Ellerd-Styles wrote with an authority based upon some experience.

I do not see that it is "trifling with the intelligence of your readers" for Mr. Ellerd-Styles to have seriously suggested that a "permanent waterproof system may be effected" with

C.T.S., provided a reasonable construction is put on the word "permanent" as used, that proper care is taken, and suitable types of fittings used for such an installation.

"Consumers' Engineer's" quotation from my previous letter tends to mislead, seeing that he ignores the reason that I gave in suggesting "short lengths of light steel conduit of ample size" for enclosing C.T.S. where run in plaster; it was surely clear that it was not primarily as a mechanical protection for the wires that I offered this hint.

Again, who claimed that it is "good practice to increase the bulk of the dielectric to replace the mechanical protection so often necessary throughout the widening field of electrical application"? Certainly not the makers. The cab-tire *sheathing* is claimed to be the *mechanical* protection of *low* insulation resistance.

In order that I may fully appreciate your correspondent's reference to "the use of this cable for all purposes," I will risk "buying" the "curate's egg" analogy if he will favour me with the "answer."

In case of a wrong conclusion being arrived at, I anticipate the possibility by assuring him that neither have I met nor do I know Mr. W. Ellerd-Styles, nor am I interested in any manufacturer of "C.T.S.," but as a live contractor, see some of the possibilities of this material, and hoped to gain by a healthy discussion if such appealed to your readers.

Another Member of the E.C.A.

[We have not been able to find any reference to a "permanent" waterproof system in Mr. Ellerd-Styles's article.—Eds. Elec. Rev.]

In reference to letters on this subject that have appeared in your recent numbers, may we suggest that it would be more satisfactory if the writers signed their names to their letters. This would help matters in two ways: First, by enabling us to give what information is required to the inquirer direct, possibly in a fuller way than can be dealt with in your columns; and, secondly, by preventing persons interested in other wiring methods, or those who rely upon hearsay evidence only, from expressing criticism of an unfair character; which is not always appreciated as such by your readers in anonymous communications.

St. Helens Cable & Rubber Co., Ltd.
J. H. C. Brooking, *General Manager.*

Warrington, *May 14th*, 1917.

The I.E.E. Wiring Rules.

The recent paper by Mr. Rawlings, abstracted in your number of April 27th, page 475, is of much importance. It may interest Mr. Rawlings to know that in a large town several leading members of the E.C.A. are using slip-joint tubing which the I.E.E. Rules specifically forbid. On protest being made by a supply-authority, the contractors stated that they paid little attention to the I.E.E. Rules, and also declared that no one had power to enforce them.

This attitude is unfortunate, as it naturally opens the door wide to the jerry wireman.

One can only hope that the I.E.E. will take steps to obtain powers to have their rules enforced, which would be greatly to the advantage of both consumers, electricity undertakings, and contractors.

A further useful step would be to set up in large centres committees formed from all parties concerned, such as supply undertakings, contractors, insurance companies, &c., which committees could arbitrate all disputes between parties. There is little doubt that if such an arrangement were undertaken it would greatly improve the quality of the work, and eliminate that curse to everybody—the inefficient contractor.

Wiring Rules.

Electric Vehicles.

I note the letter in your issue of the 4th inst. from Mr. E. F. Rowley. As to the matter mentioned in paragraph No. 1, *i.e.*, standardisation, my committee, acting in co-operation with the B.E.A.M.A. (Accumulator Makers' Section), have already secured standardisation of plate sizes, filler holes and plugs, and the maximum overall sizes of container jars for lead-plate batteries. They quite recognise the desirability of going further, and I can assure your correspondent, whose suggestions will be noted for consideration in the future, that these matters have been frequently discussed at our meetings. Owing, however, to all battery makers having to concentrate almost wholly on war work—in most cases with depleted staffs—it is impossible, while the war lasts, to do anything more in the direction of standardisation.

As to the proposals made under (2) in Mr. Rowley's letter, he is aiming at an ideal which I hope we shall some day achieve. As, however, capital will probably be scarce for some years after the war, I fear some time must elapse before such a scheme could be launched. Mr. Rowley speaks of the difficulty of charging seven or eight batteries of different voltages. Allow me to say, as one having had some two years' experience of running a public charging station and garage, that in the case where the number of cells is in line with the recommendations of my Committee, *i.e.*, not in excess of 44 lead-plate cells, no particular difficulty is experienced. Vehicles in our garage have batteries varying in the number of cells from 40 to 44. To be able to deal with such variations a properly designed charging switchboard is, of course, necessary.

Frank Ayton,
Hon. Secretary.
The Electric Vehicle Committee of Great Britain.

Ipswich, *May 10th*, 1917.

The Deterioration of Turbine Blading.

The interesting and instructive paper on the above subject recently read before the South African Institute of Engineers by Mr. A. Fenwick, has justly received a wide publicity in the technical Press of this country, and it is to be hoped that our manufacturers and users of turbines will take advantage of such a complete and thorough statement of working results. There is, however, a danger that, in the case of those who are not thoroughly familiar with all the circumstances, doubts and fears as to the reliability of impulse turbines may arise, which will tend to unjustly discredit this type of turbine as built in this country. In the hope that these fears may be removed, we trust that we, as the owners of the Curtis turbine patents for land purposes in this country, may be allowed to place before your readers a few words of explanation and information.

In the first place, it should be noted that elsewhere it has been stated that all the turbines referred to in Mr. Fenwick's paper are of one particular firm's make, and that the failures recorded are not due to the type of turbine described, but to the use of improper materials or design.

When we took up the manufacture of Curtis turbines, about 14 years ago, the blades were cut from solid rings—the material was mild steel, and was found to be serviceable, particularly in the high-pressure stages. Towards the exhaust end, owing to an increasing amount of moisture in the steam, erosion would commence after some 6,000 hours' working. This deterioration was augmented in some cases by ordinary rusting taking place while the turbine was out of service, and due to leaky stop valves, the blading standing in a warm, damp atmosphere. Many of these early turbines are still running, and have suffered less in efficiency than would be expected from the appearance of the blading, thus confirming Mr. Fenwick's observations.

It was early recognised that a more suitable material was wanted for the blades, and systematic investigations were started by us to find a material possessing the following characteristics:—

1. Non-corrosive in steam and water.
2. Resisting erosive action of high steam velocities.
3. High tensile strength.
4. Retention of initial physical properties.
5. Adaptability for manufacture.
6. Reasonable cost.

It will not be necessary here to relate the methods employed, or give all the results of our investigations. Those interested may be referred to a paper read by our chief chemist, Mr. W. B. Parker, F.I.C., before the Institute of Metals (*Journal* of the Institute of Metals, 1915, Vol. XIV), written for the purpose of soliciting the active assistance of metallurgists towards getting the most suitable material for turbine blading.

Among the non-ferrous alloys we have found that high-grade phosphor bronze best filled the above given requirements, and after several years' experience we have found none better. This alloy has initially a yield point of 12 tons, and tensile strength of 24 tons. After being exposed to high steam temperature the alloy ages, *i.e.*, the yield point is lowered, and somewhat in proportion to the temperature to which it is exposed. This reduction in strength is, fortunately, not important, as the shortest and least stressed blades are exposed to the greatest heat. We believe that the phosphor bronze has lately been adopted for impulse marine turbines, and with satisfactory results.

The output of steam turbines for a given R.P.M. is gradually growing, and the blading stresses have correspondingly increased, and to such values that the phosphor-bronze alloy is not strong enough for the requirements at the low-pressure end of the turbine. Where this greater strength is required, steel, or steel alloys, are used.

To avoid corrosion high-percentage nickel-steel looked most promising, and was experimentally tried by most turbine builders. Two machines which we built were provided with 25 per cent. nickel-steel blading, which came to grief after less than a year's service. The behaviour of this alloy is most mysterious, as pointed out by Mr. Fenwick, and we believe there is no satisfactory explanation to-day as to the real cause of failure, our own investigations being inconclusive. Even with so low a percentage of nickel as 3 to 5 per cent. trouble may be experienced owing to the tendency of nickel to segregate when pouring the ingot, and we have therefore for some time past been using a high-grade open-hearth carbon steel (having a higher percentage of manganese than usual), so as to obtain a material of great tensile strength, dependable and giving constant results. This steel is not affected by corrosion to any greater extent than steel containing a permissible amount of nickel, and we find that

corrosion is not appreciable if the feed-water is pure and no deleterious compounds are introduced into the boiler, and, further, if the turbine is kept dry while standing.

It would be desirable, however, if a non-rusting blading material, having great tensile strength, could be obtained.

Experiments are in progress in this direction with what is known in the cutlery trade as "rustless steel," but it is too early yet to say if this alloy will stand the test of time.

With regard to nozzle and guide blade material, there is no doubt that the serious troubles described by Mr. Fenwick are mostly due to the employment of 30 per cent. nickel-steel alloy, and partly to too thin guide blades. First-stage nozzles exposed to high pressure and temperature with cast-iron division walls, as mentioned by Mr. Fenwick, could only be expected to give the trouble experienced. Bronze alloys have been found most satisfactory for this purpose, especially when used for extra high temperatures, and the extra cost involved is well justified. The most suitable material for guide blades, according to our own experience, is a good grade of mild steel. If a non-rusting steel can be obtained for the longest rotating blades, this material will be equally useful and welcome for the guide blades.

The drop in pressure across a diaphragm is considerable in the first stages of a turbine. Mr. Fenwick mentions a drop of 6 lb. across the diaphragms of turbines in classes 2 and 4. It should be pointed out that this is the average pressure difference, and in the case of the first diaphragm the drop is about four times this amount, increasing the stress per blade to four times that given in Mr. Fenwick's table. We believe that cast-steel diaphragms should be used where the pressure drop is great, the diaphragm being provided with suitable port holes, and having separate nozzle segments bolted to the diaphragm. With this construction, all serious bending stresses in the guide blades are avoided, and the extra expense, we think, is justified. Where cast-iron diaphragms are used, the metal should be carefully selected so as to avoid excessive growth, which is mostly due to the presence of too much silicon.

In conclusion, we would express the hope that the proposed national investigation of blading material will be taken in hand without delay.

For The British Thomson-Houston Co., Ltd.
FREDERICK SAMUELSON.

Rugby, *May 15th*, 1917.

I have read with interest the articles appearing in your issues of May 4th and 11th on the paper contributed by Mr. A. Fenwick to the South African Institute of Engineers *re* the above.

Although you draw attention to the source of manufacture in a footnote, the fact that the turbines described are wholly of German manufacture is not disclosed in the extract, and I write to draw attention to this point to prevent British manufacturers being prejudiced.

From experience of plant manufactured by the leading British makers extending over the last 12 years, deterioration only takes place where unsuitable boiler feed is used.

The greater success of the British turbine builders is no doubt due to design and careful selection of material used in construction of the turbine blading.

Charles P. Sparks, M.I.E.E.

London, E.C., *May 15th*, 1917.

BUSINESS NOTES.

The Australian Association of British Manufacturers and their Representatives.—The report for 1916 of this Association has been received from Melbourne, and it includes a statement of the activities of the Executive Council, which controls the Association in the Victorian capital, and of the Sydney Council, which operates in New South Wales. Both sections of the Association have been enaged on the question of the Federal income-tax, and they display a very natural pleasure at the success of their endeavours to bring about the repeal of Sec. 15 of the Income-Tax Assessment Act of 1915.

Urgent representations were made by the Association to the Prime Minister, as well as to all members of both the Australian House of Representatives and the Australian Senate, that the policy of Australia should be, first, to protect Australian industries; and, second, to promote trade between Australia and the United Kingdom, and that, as far as the latter trade was concerned, such policy would be materially assisted by encouraging direct representation of British manufacturers in Australia. The effect of the taxation falling under the Section in question was directly to discourage such direct representation, because the manufacturer who employed a local agent was made liable to pay tax on all his sales to Australia, while his competitor who carried on business by means of correspondence or catalogues, or through a London, New York, or other buying house, escaped taxation altogether. This in itself constituted a glaring iniquity in penalising one manufacturer and letting another go "scot free."

Cases had occurred in which overseas manufacturers had cancelled their Australian agencies in order to avoid payment of this taxation. The Association asked that the Government should bear in mind that agents paid both Federal and State income-taxes on their commission, or profit on their transactions, and also employed labour in their business, so that the closing down of such agencies not only robbed the agent of his livelihood, but deprived the Governments of tax payable on his earnings, and also reduced employment. Another point driven home by the Association provides incidentally an interesting commentary on the exhortations addressed to the home manufacturer to employ resident agents or open actual branches abroad, rather than rely upon catalogues, correspondence, and occasional visits. One of the reasons put forward by the Australian Association of British Manufacturers and their Representatives for the repeal of this Federal income-tax was that the British manufacturer did employ resident agents, whilst the foreign manufacturer contented himself with sending an occasional traveller, who, nine cases out of ten, would get away without paying tax on behalf of his principal. Through this difference of method, a direct preference accrued to the foreign in competition with the British manufacturer. Moreover, as many British manufacturers had taken up the position that such taxation must be borne by their Australian agents as part of the agency expenses, it was feared that such agencies would become unremunerative, and be relinquished.

As the result of this very clear and emphatic statement of the case, the Council of the Association take justifiable credit to themselves for having, as already described, obtained the repeal of the objectionable section. Its repeal means that British manufacturers will not now be liable to pay Australian income-tax on goods sold by them to buyers in Australia, merely because they have an agent or representative in Australia who receives a commission or remuneration in connection with such sales. Under the original section, which was law and remained in force from November, 1915, when it was passed by the Federal Parliament, until its repeal in December, 1916, British manufacturers were liable to pay income-tax in most cases at the rate of 1s. 6d. in the £ on 5 per cent. of the invoice value of all goods sold to persons in Australia if any person in Australia received a commission or remuneration in respect of the sale of the goods. The success of the Association in this respect will result in a considerable direct monetary benefit to all British manufacturers carrying on business with Australian customers by means of an agent in Australia.

It is satisfactory to learn from the report that the Association intends keeping a careful watch on behalf of the home trade on the new import duties legislation when it is introduced again. In the meantime, they have successfully approached the Prime Minister of the Commonwealth and the Prime Ministers of the various States, with a view to preference being granted to goods of British manufacture when purchases are made by departments of their respective Governments, such preference to be in addition to the ordinary preference obtained by goods of British origin under the Customs Tariff. In concluding their report, the Council allude to the great difficulties experienced by British firms trading with Australia, not merely on account of shortage of labour and raw material, but also due to lack of freight. It is admitted that American and Japanese competitors have been taking every advantage of these circumstances, and doing everything possible to increase the Australian business. The Council have therefore invited members to co-operate by doing everything possible to assist Great Britain to triumph in the trade war which must be fought after the termination of the present hostilities.

Competitive Imports.—The Association has forwarded with its report a tabular statement, compiled by H.M. Trade Commissioner in Australia, showing statistically the share of the United Kingdom, British Dominions, and the United States respectively, in Australia's imports of competitive manufactured merchandise.

The totals for 1914-15 and 1915-16 are shown below :—

Imports of competitive manufactured merchandise.	1914-15.		1915-16.	
From United Kingdom ..	£31,732,974	64·9 %	£34,662,821	62·18 %
,, Brit. Doms. & Possns.	1,899,075	3·8 %	2,473,470	4·45 %
,, United States ..	7,430,170	15·2 %	10,594,793	19·06 %
,, All other countries ..	7,804,792	16·1 %	7,948,185	14·31 %
Total	£48,867,011	100 %	£55,579,269	100 %

The following figures in respect of metals (manufactured) and machinery for 1915-16 will be of interest :—

	Preference.	Non-preference.
Imports of metals manufactured .. Total	£13,533,115	£26,808
From United Kingdom	8,683,440	26,771
,, British Dominions & Possessions..	607,215	2
,, United States	3,736,228	14
Machinery .. .. Total	£3,209,297	—
From United Kingdom	1,485,153	—
,, British Dominions & Possessions..	181,523	—
,, United States	1,389,158	—

Plant for Sale.—The Wolverhampton B.C. Electricity Works has for disposal one 500-KW. Belliss-Parker 500-volt D.C. generator set, and one 500-KW. Willans-E.C.C. 500-volt D.C. generator set, both complete, with surface condensing plant. Full particulars are given in our advertisement pages to-day.

Patents and Alien Enemies.—The CHESHAM SUPPLY CO., LTD., have applied to the Board of Trade to avoid, or suspend, the series of patents from No. 23,132/05 to No. 4,692/13, granted to the makers of the Bosch magneto, for details of the mechanism.

MESSRS. EDWARD BENNIS & CO., LTD., have decided not to proceed with their application in respect of Patent No. 5,041/13, granted to L. & C. Steinmuller.

Meter Prices.—The Walsall Electrical Co., Ltd., announce increases in prices of meters, both large and small, as from May 15th.

Lamp Manufacture in Spain.—"Thales," Sociedad Espanola de Lamparas Electricas is the name of a new concern which has recently been organised in Barcelona, with a capital of £2,000, to carry on the manufacture of electric lamps.

Openings in Italian Markets.—In its latest list of trade openings, the British Chamber of Commerce for Italy (Inc.) (Genoa) includes the following inquiries :—

No. 1,276. Rome agent seeks connections in rubber, colours, sulphates, coal, iron, chemicals, electrical machinery, instruments and apparatus, woollen piece-goods. R. A. G. Q.

No. 1,279. Party at Genoa would represent on commission manufacturer of chemicals, machinery and engineering sundries. G. C. L.

No. 1,289. Agents at Florence would handle on commission, hardware, ironmongery, and metals. F. D. D. B. F.

No. 1,290. Engineer at Genoa would buy on commission or for own account, machinery and metals for shipbuilding. G. I. R. M. C.

No. 1,294. Party at Naples would buy for his own account, hardware, ironmongery, fire-bricks, machine tools. N. E. F.

No. 1,296. Rome firm would handle coals, pig iron, tin, copper, lead, fire-bricks, &c. R. D. L. C.

No. 1,299. Leghorn agent would represent shippers of chemicals, metals, coals, &c. L. G. F.

No. 1,300. Genoa agent would represent on commission, exporters of coal, fire-bricks, &c. G. L. B. C.

No. 1,312. Firm at Genoa would buy for own account, or represent on commission, chemicals, caustic soda, soda ash, silicate of soda (glass), colphony, paraffin wax, iron, pig-iron, steel, oils, engineering articles, electrical sundries, &c. G. D. B. B.

Patent Application.—Application has been made for leave to amend Patent No. 12,867, of 1914, granted to Mr. C. O. Bastian, for "Improvements in, or relating to, electrical resistances." Particulars appear in our advertisement pages to-day.

Italy.—Accidierie Ellettriche is the style of a joint stock company launched at Sesto S. Giovanni for the establishment and working of an iron foundry and steel works, and trading in the products. The capital is fixed at 300,000 lire.

Catalogues and Lists.—Consolidated Pneumatic Tool Co., Ltd., 9, Bridge Street, Westminster, S.W. 1.—46-page electric tool catalogue (No. 8E) ; new edition. Descriptive matter and tabulated sizes, weights and code-words appear relating to D.C. drills and A.C. drills, single, two and three-phase drills, rail drills, portable generating plant and air compressors, grinders, coal and ore borers, electric hammer drill, portable electric blower, drilling stands, couplings for connecting cables, &c. The pamphlet is fully illustrated, some of the pictures showing the works ; there is a code-word index and a thumb index to sections.

British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park.—New series of illustrated leaflets, showing a number of their recent switchgear installations. The switchgear at the L. & N.W. Railway Co.'s power station at Stonebridge Park, also the sub-station switchgear at that company's sub-stations at Willesden and Dalston, are clearly shown, also a 35,000-volt A.C. switchgear equipment at the works of Det Norske Nitridaktieselskap ; L.T. switchgear at the Clydebank Works of the Singer Manufacturing Co., Ltd. ; and sub-station switchgear for the Walsall Corporation.

Dissolutions and Liquidations.—Braithwaite & Kirk, 117, Victoria Street, London, S.W.—Mr. A. E. G. Braithwaite is retiring from the partnership for health reasons, and the business has been taken over by Messrs. J. H. Humphryes & A. Anderson, and will be continued by them as Braithwaite & Co. They will attend to all debts due to and liabilities of the late firm.

Collins & Price, electricians and electrical engineers, 35, Moorfields, Liverpool, and Hoylake.—Messrs. F. Collins & C. E. Price have dissolved partnership. Debts of the Liverpool branch will be attended to by Mr. Collins and those of Hoylake by Mr. Price.

Harman Electric Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. P. F. Huddleston, 72, Finsbury Pavement, E.C., by June 30th.

Pump and Power Co., Ltd.—A meeting is called for June 18th at 38, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. L. R. Sankey.

Trade Announcements.—On the 21st inst., Messrs. W. T. Henley's Telegraph Works Co., Ltd., will remove their Birmingham branch offices and stock rooms to Broad Street Chambers. The new premises will afford facilities for carrying much larger stocks of electric wires and cables, flexible cords, jointing materials, boxes, tapes, &c., to meet war demands for urgent delivery. New telephone number : Midland 790. Telegraphic address unaltered : "Henletel," Birmingham.

The new English carbon black and paint works of Fuller's Carbon and Electrical Co., Ltd., are now in operation, and the company are in a position to supply orders for the electrical and engineering trades and War Office and Admiralty specifications.

Mr. J. M. Dering announces that he is continuing the business of his father, the late Mr. J. M. Dering, sen., electrical engineer, of Anglesia Place, Gravesend.

Book Notices.—"Elementary Principles of Wireless Telegraphy" (Part II). By R. D. Bangay. London : The Wireless Press, Ltd. Price 2s.

"Science Abstracts" (A and B). Vol. 20, Part IV. April 30th, 1917. London : E. & F. N. Spon, Ltd. Price 1s. 6d. each net.

Actions Physiologiques et Dangers des Courants Electriques. By J. Rodet. Paris : Gauthier-Villars. Price 3 fr. 25 c.—In this work the author discusses the various physiological effects produced by electric currents upon the human organism, the nature of accidents due to electric currents, and the conditions under which death may result. One chapter is devoted to experiments on horses, and another to accounts of a number of accidents to persons. In the remaining chapters the precautions which should be taken to prevent such accidents, and the methods of treatment recommended for sufferers from electric shocks and burns, are detailed. The book is practical, and deals ably with a subject which is of great and increasing importance.

LIGHTING AND POWER NOTES.

Blackpool.—Mr. Charles Furness, the borough electrical engineer, estimates a surplus of £2,000 this year on the electricity undertaking, largely due to the increased charges just sanctioned, as against a loss of £887 last year. Some economies are expected in the working expenses, and there will be about £2,000 capital expenditure at the works on contracts accepted last year in connection with the condensing equipment.

Bradford.—Street Lighting.—At last week's meeting of the City Council the discontinuance of public street lighting during May, June, and July was agreed to.

Continental.—France.—The Government has approved the scheme, as a project of public utility, for the establishment of a hydro-electric power station at Fontpedrouse (Pyrenees Orientales) to utilise the water power of the River Têt and its tributary Riberolle to provide the electrical energy for the operation of the railway between Perpignan and Villefranche.

It is reported that the Société Electrometallurgie de Dives has acquired a large area of land, and also the right to utilise certain waterfalls in the district of Limoges, with the object of establishing a large new hydro-electric generating station.

Epsom.—Provisional Order.—The B. of T. has granted a provisional order for electric supply in the parishes of Cuddington and Ewell, in the area of the Epsom R.D.C., to the South Metropolitan Electric Tramways and Lighting Co.

Harrogate.—Year's Working.—The total income of the electricity undertaking for the year 1916-17 was £19,546, an increase over the estimates of £435. The expenditure was £19,540, leaving a debit balance of £75, which was better than the estimate by £379. In the previous year the Committee had a surplus profit of £1,730, but the extra cost of coal has been £900, and the loan charges and income-tax have increased, while the income has been less.

India.—The Government of India has had under consideration the question of the obligation laid on licencees under Clauses 6 and 7 of the schedule to the Indian Electricity Act of 1910 to supply energy on receiving requisitions in due form, in view of the ban placed on the supply of plant, &c., for the extension of industrial undertakings otherwise than for war purposes, as it is realised that it may be impossible during the war to fulfil this obligation where the existing plant is fully loaded, but in view of the protective phrases (occurrences beyond his control, Schedule, Clause 6 (1), and without reasonable excuse, the burden of proving which shall lie on him (Sec. 42B), it is not considered necessary at present to make any emergency provision in the matter.—*Indian Engineering.*

Leigh (Lancs.).—Price Increase.—Owing to the increased cost of materials, the Electricity Committee has decided to increase the price of electricity for lighting purposes by 15 per cent., as from July 1st.

London.—Southwark.—At a meeting of the B.C., Councillor Hewitt drew attention to a proposal contained in the accounts to pay £8,000 out of the general fund to meet the deficiency in the accounts of the electric light undertaking. The annual accounts had not yet been presented, and therefore he maintained that the proposal was most irregular. He moved that the item be referred back to the Finance Committee for reconsideration. It was pointed out that the bank had asked the Council to reduce the overdraft on the electricity account of £13,000, and the borough treasurer suggested £8,000 as the amount which would have to come from the general funds of the Council to make up the possible loss on the electric light account. The proposal to refer the matter back to the Committee was carried.

Poplar.—The Electricity Committee reports that it has further considered the report of the engineer on the provision of generating plant to meet next winter's demand. The Government adviser has had the position before him in relation to Poplar and adjoining boroughs, and is prepared to sanction the erection of a new 5,000-KW. generating set at Poplar provided an additional cable is laid to Stepney. The Committee recommends the provision of an additional 5,000-KW. generating set and the laying of an additional E.H.T. cable from the generating station to Stepney boundary, at a cost of £30,500.

Morocco.—Proposed Exploitation of Water Power.—According to the local Press, a consortium, comprising the French companies and firms of Schneider (Creusot). Pavillier, Giros and Loucheur, Compagnie Marocaine, Compagnie Générale, and the P.L.M. and Orléans Railway Companies, has been formed to exploit the water power of Morocco. The consortium, it is stated, proposes, in the first place, to utilise the falls of the Oum-er-Rebia River, and probably later the river heads in the Atlas Mountains.—*Board of Trade Journal.*

Newcastle (Co. Down).—Street Lighting.—At a meeting of the Urban Council, a letter was read from the Irish Towns Electric Light and Power Co., offering to renew the contract for street lighting for three years for £240 per annum, an increase of £38—this increase to be a set-off against rates payable in respect of plant—the cost of private lighting, 6d. per unit, to remain unchanged. The Council was of opinion that, in view of the restrictions on lighting, the ratepayers were not getting adequate value for outlay, and decided to postpone consideration of the matter.

Richmond (Surrey).—The Richmond Electric Light and Power Co., Ltd., is applying for an Act covering a number of electric supply provisions, alteration in price for electricity, amendment of agreements, &c.

Rochdale.—Price Increase.—The T.C. has approved the Electricity Committee's recommendations that the prices for current should be increased as from the 16th inst. The recommendation to impose a further increase of 15 per cent. on the charge for current supplied to the tramway department was defeated by 20 votes to 14; members of the Tramways Committee said the proposed increased charge of £1,720 was nearly equal to last year's profit, whilst the tramway reserve was only £24,000, instead of the £70,000 which it ought to be. The chairman of the Electricity Committee said the total estimated increase in receipts from the new charges would be £10,126, including £2,000 as a result of the coal clause now in operation with several firms.

Sunderland.—The T.C. has received a communication from the I.M.E.A. calling attention to the need for more adequate representation on the Committee appointed by the B. of T. to consider the report on the further supply of electrical power, and asking the Council to pass a resolution urging the matter. Alderman Bruce moved accordingly, adding a proposal that the town clerk should bring the matter before the Corporate Municipal Association. This was agreed to. In reply to a question whether the Committee was getting higher prices for current than formerly, Alderman Bruce stated that the bulk of the supply was furnished under contracts entered into 10 or 15 years ago. The flat rate price of current for householders had been increased about a year ago.

Wolverhampton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £2,410 to lay electricity mains to local works.

At the monthly meeting of the T.C., a resolution urging that municipal electrical authorities should have more adequate representation on the B. of T. Committee on Electricity Supply, was adopted.

Worksop.—Price Increase.—The U.D.C. has decided to advance the charges for current by ½d. per unit.

TRAMWAY and RAILWAY NOTES.

Bingley.—In reference to the recent consultations between the Bingley and Keighley authorities with a view to the possible extension of the tramway service, so as to link up completely Bradford, Bingley and Keighley, the Bradford Tramways Committee has now intimated that it is prepared to consider laying a line from Cross Flatts to Keighley, provided the widening and improvement of Stock Bridge is first satisfactorily settled amongst the authorities concerned.

Blackpool.—Revenue Estimates.—The receipts from the Corporation tramways are estimated this year at £80,000, as against £94,000 last year, with a surplus of £5,000, as against £19,300 last year. Income-tax in 1913 was £876, but it is estimated at £6,000 during the present year. War allowances and interest and sinking fund charges make the war responsible for over £19,000 extra expenses.

Darwen.—The Tramways Committee has sustained a loss of £2,720 on the year's working.

Keighley.—War Bonus.—The conductresses on the Corporation tramways have sent in an application for a war bonus, but the Committee, considering the matter last week, felt that the women were receiving wages equal to those paid to women workers generally in the town, and that many of them, in addition, were receiving allowances as soldiers' wives. The women conductors have been in service a little over a year, and their average wage is £1 7s. per week, apart from the ticket bonus system, which, according to the April returns, yielded them about 9s. each for the month. Some of the women are members of the Tramwaymen's Union, but the application has not come from the Union; the women number about 30.

The tramway service was suspended on Saturday morning, owing to a strike of the women conductors with a view to obtaining the full war bonus; the men also supported the women. The Tramways Committee points out that a loss of £168 resulted on the last year's working, and that the prospects are that a much greater deficiency will result from the present year's working.

London.—L.C.C.—The Highways Committee reports that, as a result of its negotiation in connection with the arbitration award for the purchase of the portion in London of the undertaking of the London United Tramways, terms have now been agreed which the Committee considers will provide for a satisfactory settlement, both as regards purchase and the working of the tramways. The lines affected are situated in the Metropolitan Borough of Hammersmith, are about 5½-route miles in length, worked on the overhead trolley system, and include the London termini at Hammersmith Broadway and at Shepherd's Bush Green of the system of the company, which extends to Hampton Court, Hounslow, and other points in the county of Middlesex. The arrangements now proposed include provision for running arrangements between the Council and the company. The amount to be paid by the Council for the lines about to be acquired is £235,000, and, in addition, £12,000 towards the company's costs of the arbitration and subsequent proceedings. The Chiswick power station, including the whole of the plant, will be transferred to the Council. The Finance Committee, reporting on the matter, states that the total capital expenditure involved will be £320,899, including, in addition to the £247,000 paid to the company, £10,000 for counsel's costs, and £63,899 for reconstruction of part of the purchasable lines. In addition, further expenditure will be necessary for junction lines, &c., necessary to give effect to the proposed through-running arrangements. The Finance Committee understands that it is expected that this will be recouped by the increased traffic due to through-running arrangements, and that, on the basis of an annual mileage of 1,200,000, it is estimated that the balance of receipts over working expenses (including renewals, but excluding power, which will be supplied by the company free of cost) will amount to £22,917 a year. The total debt charges in the first year will be about £26,870, decreasing annually by £545. The Council is to complete the purchase not earlier than the declaration of peace, and not later than 12 months afterwards. The Council approved the capital estimate at its meeting this week.

Newcastle.—War Bonus.—The Tramways Committee has reconsidered the increased war bonus given to motormen a fortnight ago, and, after hearing a deputation of the men, increased the bonus from 4s. to 5s. weekly.

Wolverhampton.—Amended terms for the tramway service intercommunication between Bilston and Wolverhampton and Willenhall and Wolverhampton have been agreed to.

Accident.—Two cars, proceeding in the same direction, collided at Dudley, on Thursday, last week; one passenger was slightly injured.

TELEGRAPH and TELEPHONE NOTES.

Australia.—In the matter of an industrial dispute between the Marine Radio-Telegraphists' Institute of Australasia and the Amalgamated Wireless Association and others, the parties have arrived at an agreement, which provides for the payment of wages to wireless operators, who are required to hold first-class certificates of efficiency, if they are members of the union, at rates per month as follows:—First year, £9 a month; second year, £10; third year, £11; fourth year, £13; fifth year, £14; sixth year, £15; seventh year, £16; eighth and subsequent years, £16 a month; every operator, excepting when on leave, to have meals and proper living accommodation provided on respondents' vessels, or to be allowed, when temporarily ashore, 5s. a day at a home port or 7s. 6d. per day at any other port. When permanently on shore, an extra allowance to be given of £43 per annum. Thirty-eight days' leave of absence on full pay to be allowed annually. Ordinary duty to be eight hours in every 24.—*Sydney Morning Herald.*

Illicit Wireless.—The Portsmouth magistrates have committed for trial at the Hants Assizes R. G. Cole, electrical fitter, apprentice in the dockyard, on a charge of having apparatus for receiving messages by wireless telegraphy, as mentioned in our last issue. The desendant was released on bail of £10.

United States Censorship.—On May 1st an executive order signed by President Wilson was published, providing for the censorship of cable telegrams out of the United States and of telegraph and telephone messages into Mexico.

Wireless Litigation.—The United States Court of Appeal has given a unanimous decision in favour of the Marconi Co. with reference to the Fleming valve patent. The appeal was from a judgment given by the Court of First Instance in favour of the Marconi Co. in an action for infringement of this patent which it brought against the De Forest Telegraph & Telephone Co. The Fleming valve is the most sensitive detector of wireless waves so far discovered, and its value, especially in respect of long-distance wireless telegraphy and telephony, is difficult to over-estimate. The De Forest Co. included among its contentions a counterclaim for the alleged infringement of seven of its own patents. The Court of Appeal has, however, decided that there has been no infringement of six of these patents, and that the seventh invalid.—*Financial Times.*

Wireless Spies in Norway.—It is reported that signallers at a fort near Bergen recently set up a wireless station, with the surprising result that the first message received consisted of the name of a ship and the time of her departure. The message had obviously been sent from a secret station by a spy. The ship mentioned was attacked a few hours after her departure, but escaped by a lucky accident.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—August 22nd. N.S.W. Government Railways and Tramways. Thirty-six induction motors (Specification No. 488). September 19th.—One 225-H.P. synchronous motor (Specification No. 489). Particulars from Electrical Engineer's Office, 61, Hunter Street, Sydney.

MELBOURNE.—July 25th. Victorian Railways. Step-down transformer and sub-station equipment for Sandringham-Black Rock electric tramway. Particulars from the Chief Storekeeper, Railway Offices, Spencer Street.

Manchester.—May 25th. Corporation Electricity Committee. Various stores for 12 months. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Spain.—The municipal authorities of Finisterre (Province of Corunna) have lately invited tenders for the concession for the electric lighting of the town until the end of 1919.

Warrington.—May 22nd. Electricity and Tramways Committee. Underfeed mechanical stoker. See "Official Notices" May 4th.

Winchester.—Corporation. Coal for the electricity works. Electrical Engineer.

CLOSED.

Farnborough.—U.D.C. Pulsometer Engineering Co., at £112 10s.: motor and pump for the sewage works. The tender of the Aldershot Gas Co., at £74, for laying the cable and fixing the transformer, has been accepted.

Gillingham (Kent).—T.C. Transformer: British Electric Transformer Co., £137.

London.—L.C.C.—Highways Committee. Six auto-transformers in connection with the supply of additional power in the Woolwich district, £596: British Electric Transformer Co., Ltd. (the only tender received).

WAR PENSIONS BOARD.—Electric bell and fire-alarm installation at Duke of York's Schools, Chelsea: Napier, Kimber, Ltd.

Malvern.—U.D.C. Meters for a year: Electrical Apparatus Co.

Southend.—T.C. Accepted tenders:—

Worthington Pump Co.—Centrifugal pump for the supply of water to the electricity works, £53.
John Sadd & Sons.—Meter boards, £48.

Spain.—With reference to the projected underground electric railway system in Madrid, H.M. Consul there reports that the contract for the construction of the earth and masonry works of the line No. 1 of the Metropolitan Railway in Madrid has been awarded by the concessionaires of the railway to a Spanish firm.—*Board of Trade Journal.*

Sunderland.—Council. Tenders accepted:—

F. Smith & Co.—Copper rod.
Stewart & Lloyds, Ltd.—Steam and water pipe work, &c.
J. Blakeborough & Sons.—C.I. sluice valves.

Wolverhampton.—T.C. Staveley Iron & Coal Co., Ltd.: cast-iron condenser pipes, at £825.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 18th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Construction of Turbine Pumps," by Mr. A. E. L. Chorlton.

Royal Institution of Great Britain.—Friday, May 18th. At 5.30 p.m. At Albemarle Street, W. Lecture on "The Complexity of the Chemical Elements," by Prof. F. Soddy, F.R.S.

Saturdays, May 19th and 26th. At 3 p.m. At Albemarle Street, Piccadilly, W. Lectures (III and IV) on "The Electrical Properties of Gases," by Prof. Sir J. J. Thomson, Pres. R.S.

Junior Institution of Engineers.—Friday, May 18th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Metric Weights and Measures and Decimal Coinage," by Mr. E. C. Barton.

Institution of Mining and Metallurgy.—Thursday, May 24th. At 5.30 p.m. At the rooms of the Geological Society, Burlington House, Piccadilly, W. Paper on "Shall Great Britain and America adopt the Metric System?" by Mr. W. R. Ingalls. Members of the Institution of Electrical Engineers and other engineering societies are invited to attend and take part in the discussion.

NOTES.

Foundations at Dalmarnock Power Station.—In a paper read before the Scottish branch of the National Association of Colliery Managers, Mr. Sneddon described the method of piling adopted at the new Dalmarnock power station. Difficulty was experienced through river water boiling up during excavating operations; Simplex steel sheet piling was employed in place of timber, the method of jointing and interlocking assuring an efficient and water-tight construction. These piles are driven by a steam hammer, which rests on the top of the piles and drops with them; by a slight rearrangement of the apparatus and the use of a grip the piles can also be withdrawn by the hammer. In constructing the inlet culvert, which is 11 ft. wide and 34 ft. deep, considerable difficulty was experienced owing to a lake of mud being found immediately below the desired depth. Piles which pierced the crust of the mud began to move downward of their own accord. The depth of this lake proved by means of piles was some 60 ft.; some 2½-ft. diameter oak trees recovered from this part were quite fresh, and were considered to be over 1,000 years old.

The Tramways and Light Railways Association.—The annual Congress of this Association will be held at the Institution of Civil Engineers in London on Friday, June 29th, at 2.30 p.m. After the annual meeting, Mr. A. Norton will read a paper on "The Manufacture, Life, and Maintenance of Tramcar Tires," illustrated by diagrams and lantern slides. Among the subjects to be discussed will be:—"Standardisation of Conditions of Labour and Rates of Pay," by Mr. E. H. Edwardes (S. Lancs. Tramways Co.), and "Fares," by Mr. A. V. Mason (S. Metropolitan Tramways Co.). Some of the members will dine together informally and simply in the evening.

The Decimal Association.—The report of the Executive Committee for the year 1916 has been issued. It states that in no previous year since the formation of the Association has there been such a magnificent response to the efforts of the Committee, resulting in a largely-increased membership, while resolutions in favour of the decimalisation of our coinage and weights and measures have been passed by numerous important public bodies. A long list of the latter is given, from which we select the following examples:—

The Executive Council of the County Councils Association and 367 County and Town Councils; Associated Chambers of Commerce, and Chambers generally; Association of Trade Protection Societies; British Imperial Council of Commerce; Council of Manchester Association of Importers and Exporters; Court of Common Council of the City of London; East India Association; Incorporated Associations of Head Masters and Assistant Masters; National Chamber of Trade; National Farmers' Union; National Federation of Building Trade Employers of Great Britain and Ireland; Silk Association of Great Britain and Ireland; Committee on Decimalisation of the British Science Guild.

The Association of Chambers of Commerce of the United Kingdom, at its annual meeting, requested the Executive Council to arrange for the introduction of Bills to decimalise the currency and to substitute the metric system for the existing system of weights and measures, and to urge the Government to make representations to the Governments of the Dominions with the same end in view.

One of the recommendations submitted by the President of the Institution of Electrical Engineers to the Board of Trade Committee on the Electrical Trades, was "that the use of the metric system be made compulsory after a reasonable period, and during this period all trade catalogues make use of both the British and the metric systems."

At the annual general meeting of the London City and Midland Bank, the chairman, Sir Edward Holden, spoke very strongly in favour of the decimalisation of coinage and weights and measures, and supported the system of coinage advocated by the Association. At the annual meeting of the Institute of Chartered Accountants, the President, Sir H. Woodburn Kirby, in outlining what was essential in equipping ourselves to win back our foreign trade from the Germans, emphasised the importance of establishing the metric system of weights and measures and a decimal system of coinage. Of the replies received in answer to a questionnaire, kindly sent out by Messrs. Geo. S. Smith Dalby Welch, at their own expense, to 25,000 of the largest firms in the United Kingdom, asking if they were in favour of the decimalisation of the coinage and the adoption of metric weights and measures, 99 per cent. were in favour. Of the replies received in answer to a similar questionnaire sent out by the British Engineers' Association, 90 per cent. were in favour of the early adoption of a decimal system of coinage, and 85 per cent. in favour of the compulsory use, after a short transition period, of the metric system of weights and measures.

Manchester, which was formerly a stern opponent of the projected reforms, is rapidly becoming a decimal stronghold, and possesses a Decimal Association of its own.

Various methods of decimalising the coinage were put forward for consideration, and were also very fully discussed in the Press. Whilst admitting that there was something to say in favour of each, particularly the dollar and cent of the United States and Canada as being the coinage of the largest section of the English-speaking people, and most readily adaptable owing to the cent being equal to our halfpenny, the Committee came to the conclusion that the most practical scheme for British use would be one that would permit of our maintaining our sovereign subdivided into 1,000 mils, or the sovereign as 10 florins, with the florin subdivided into 100 cents. Of these, the latter was preferred, as it

possessed the advantages of the former whilst being simpler for accounting and general use.

Owing to the almost universal use of the metric system, no alternative system of decimalisation could be put forward with any chance of support; there were some associated rather more with the works side than the sale side of business who, whilst admitting the advantage of decimal calculation, felt that the decimalisation of the foot or yard, or some other British measure, would meet the desired change, but the Committee thinks that even these are now convinced that there is no alternative to our mystifying methods of to-day but the metric system.

The recommendations of the Dominions Royal Commission on the desirability of introducing metrical weights and measures, and a new style of coinage based on the decimal system, state that there is clearly in the Dominions a considerable body of opinion in favour of this change. The members of the Commission are of opinion that the termination of the war will bring with it an unequalled opportunity for securing this much-needed reform, and recommend that the Government, and the Governments of the Oversea Dominions, should then co-operate to establish throughout the Empire a uniform coinage based on the decimal system, and uniform weights and measures based on the metric system.

Our Consuls have continually drawn attention to the necessity of adopting the metric system of weights and measures and cataloguing and invoicing in the language of the country in which trade is sought, and have emphasised time after time how contracts and orders have been lost through neglect of these essentials. Our allies in this world war are also most anxious that we should adopt the metric system of weights and measures, with a view to increasing our trade with them after the war.

The Committee strongly commends to the notice of educational authorities and public bodies the formation of a Central Institute of Commerce in London, with a Sub-Institute for each country or group of countries speaking the same language, in which young men could qualify as representatives to such countries, or for positions in firms trading with such countries at home, not only by learning the language, but also by obtaining a thorough knowledge of the traditions, customs, and manners of the country, in addition to up-to-date methods of introducing business. In such institutions should our aspirants for Foreign Office, Legation, and Consular appointments graduate, and from such institutions should our manufacturers and shippers be able to obtain not only their accomplished men, but all necessary information to assist them in successfully competing in the world's markets.

Pending the formation of such institutions and the adoption of the reforms of coinage and weights and measures, the Committee advocates the use of the metric weights and measures, and the language of the country in which business is being sought, in all catalogues, estimates, and contracts now being prepared.

Owing to the extent of propaganda work projected by the Committee in 1916, it was decided to delegate the arrangement of it to a Sub-Committee composed of the following members:—Sir Richard Bubridge, Bart. (chairman), Mr. G. F. Garnsey, Dr. W. W. Hardwicke, Mr. A. J. Naughton, Mr. Theodore McKenna.

The large number of lectures given in various parts of the kingdom during the year were most successful, generally resulting in a vote in favour of the projected reforms. Most of these lectures devolved upon Mr. E. C. Barton, who, being an Australian, was in a position to speak as to the disposition of some of the Dominions whilst advocating the adoption of the reforms by the Mother Country. He has recently been elected a member of the Executive Committee.

The accounts show income £606, expenditure £518, surplus £88.

A meeting will be held at the Mansion House, under the presidency of the Lord Mayor of London, about the middle of June, to further the movement towards the adoption of decimal coinage and metric weights and measures. Full particulars may be obtained from the secretary of the Decimal Association, Finsbury Court, E.C. 2, by whom the meeting is being organised; application for free tickets of admission should be made as early as possible.

Volunteer Notes.—COUNTY OF LONDON ENGINEER VOLUNTEERS (FIELD COMPANIES).

Orders for the Week. By Lieut.-Colonel C. B. Clay, V.D., Commanding:—

Monday, May 21st.—Technical for No. 3 Company, Right Half Company, at Regency Street. Drill No. 3 Company, Left Half Company. Signalling Class.

Tuesday, May 22nd.—Lecture, 6.30, Company Commander Castell, "Knots and Lashings and Trestle Bridging." Physical drill and bayonet fighting, 7.30 to 8.30.

Wednesday, May 23rd.—Drill, No. 1 Company, Left Half Company, 6.15.

Thursday, May 24th.—Drill, No. 2 Company, Left Half Company. Ambulance Class by M.O., 6.30. Signalling Class.

Friday, May 25th.—Technical for No. 2 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, at 6.30 to 7.30.

Saturday, May 26th, and *Sunday, May 27th.*—See Special Orders.

(By order), MACLEOD YEARSLEY, *Company Commander and Adjutant.*

Foreign Trade.—THE APRIL FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	April, 1917.	*Inc. or dec.*	*4 months*, 1917. *Inc. or dec.*
IMPORTS.			
Electrical goods, &c. ...	106,177	− 42,398	+ 45,583
Machinery	597,541	− 40,376	− 144,251
EXPORTS.			
Electrical goods ...	220,705	− 52,669	− 13,518
Machinery	1,281,765	− 2,583	+ 1,233,861

The Board of Trade Committee on Electricity Supply and the I.M.E.A.—The Council of the I.M.E.A., on May 4th, resolved that the President of the Board of Trade should be urged to give more adequate representation to local authorities upon the Committee appointed by him to consider and report on the supply of electrical power in the United Kingdom, and circularised the members, requesting that each local authority should adopt resolutions on the lines of those passed by the City of Bradford on May 3rd, and transmit the same to the President of the Board of Trade and to their local members of Parliament at the earliest possible date.

The Bradford resolution was almost identical in terms with that passed by the West Ham Electricity Committee, and reported in our issue of May 4th; it sets forth that the Council is of opinion, having regard to the important part at present played by local authorities in the supply of electrical energy and the extensive character of the capital commitments in relation thereto, that local authorities owning electrical undertakings are inadequately represented on the Committee appointed by the President of the Board of Trade to consider and report on the future supply of electric power for all classes of consumers in the United Kingdom, and strongly urges upon the President of the Board of Trade the necessity of increased representation being given to them, in the interests of both the ratepayers and the consumers of electrical energy.

In a letter to Sir Albert Stanley, dated May 7th, the hon. secretary of the I.M.E.A., Mr. H. Faraday Proctor, emphasised the inadequate representation of the local authorities, and stated that the interests which the local authorities have at stake, and the services which they render in the supply of electricity, far outweigh those of all other undertakers, the energy supplied by them being more than double that supplied by companies.

L.C.C. Employes' Wages.—The Rolling-Stock Conciliation Board of the London Council's tramway department has granted an advance of 5s. a week, to be regarded as war wages, to the undermentioned employés at car-sheds: Bodymakers, brakesmen, brakesmen's mates, controller repairers, controller and motor cleaners, fitters, greasers, plough repairers, re-wheelers and truckmen; to employés at the central repairs depôt: Armature winders, bodymakers, coach painters, colourmen, brush hands, controller repairers, magnet and coil winders, crane drivers, engineering labourers, lorry drivers, plough repairers, writers, tire-setters, wheelwrights and wiremen. Armature winders: The advances to commence as from and including April 1st, 1917.

The Highways Committee reports that requests have been received from wiremen and wiremen's mates in the electrical section of the tramway department for an increase of 2½d. and 2d. an hour repectively in their rates of pay; also from persons employed in the traffic section of the tramway department, for an increase in wages of 1s. 8d. a day, or 10s. a week, and payment at the rate of time and a half for overtime. The Committee recommends that both applications be referred to the Conciliation Boards.

Fixation of Atmospheric Nitrogen. — The *Scientific American* gives an account of an address delivered by Prof. J. E. Bucher, of Brown University, U.S.A., at the recent annual Conference of Chemical Engineers in New York, in which he announced the fixation of nitrogen from the air by a purely chemical process involving no electric power consumption.

A mixture of soda ash, powdered iron or iron ore, and powdered coke is subjected to ordinary furnace heat, and air is passed over the heated mixture. This results in the production of sodium cyanide, the iron remaining unchanged after acting as a catalytic agent. The cyanide produced is treated in one of three ways:—(1) Treated with steam to produce sodium carbonate and ammonia, the latter of which serves as the basis of the nitrogen products used in the manufacture of fertilisers, explosives, dyestuffs, &c.; (2) treated with the carbon dioxide from the furnace to produce urea, a substance three times as rich in nitrogen as nitrate of soda, and twice as rich as ammonium sulphate, and which is, consequently, a highly concentrated fertiliser having the added agricultural advantage of non-acidity; or (3) decomposed electrolytically to produce metallic sodium and cyanogen. The former of these products has great commercial value, while the latter, by absorption by hydrochloric acid, yields oxamide, which is an invaluable fertiliser containing 30 per cent. nitrogen, but hitherto unavailable on account of its high price.

The production of artificial nitrates by the fixing of atmospheric nitrogen has for 20 years been hindered as a commercial process by the necessity for cheap and unlimited electric power, and the industry has been, consequently, confined to Norway, the United States of America, and other countries possessing abundant water power. The present urgent demands for these products, both for munitions of war and in agriculture, make Prof. Bucher's announcement of great interest, and the successful commercialisation of the process, which is still in the laboratory stage and undergoing large-scale trials, would have far-reaching results.

The matter is of importance to the electrical industries in view of the threatened competition with the electrical processes at present employed.

Parliamentary.—In the House of Commons, on Monday, the West Kent Electric Power Bill was read a third time. The Lancashire Power Construction Co.'s Bill and the Nottinghamshire and Derbyshire Tramways Bill were read a second time.

Export Standardisation Rules.—Mr. D. N. Dunlop, secretary of the B.E.A.M.A., writes as follows:—"The recent announcement in the technical Press to the effect that the Council of this Association have issued a set of British export standardisation rules for electrical machinery having, unfortunately, given rise to misapprehension, I am desired to state that these rules are in no way intended to replace the British standardisation rules for electrical machinery which are issued by the Engineering Standards Committee to cover British made plant for home and export trade, and in the drafting of which the Association is closely and cordially co-operating."

Canadian Water Powers Report.—We have received from the Canadian Department of the Interior, Water Power Branch, the annual report for the year ending March 31st, 1916. A summary of the year's work is as follows :—

1. The amendment to the Dominion Lands Act to prevent the disposition in any other way, except under the Water Power Regulations, of lands valuable for water-power purposes.

2. The re-purchase for $100,188·51 by the Government of the land dominating Silver Falls site on the Winnipeg River, thereby ensuring for all time to come the control by the Government of all the natural fall on the Winnipeg River between Lac du Bonnet and Lake Winnipeg, representing a total power capacity, under regulated flow, of 190,000 continuous 24-hour H.P.

3. The commencement of investigations of the water-power resources of the Province of Nova Scotia, under co-operative agreement with the Nova Scotia Water Power Commission.

4. The completion and installation of the water power exhibit in the Canadian Pavilion at the Panama Pacific International Exposition, and the participation by Canadian engineers, in co-operation with the engineers of this branch, in the proceedings of the water-power section of the International Engineering Congress, held at San Francisco during the Panama Pacific International Exposition.

5. Completion of the extensive power and storage investigations on the Winnipeg River.

6. Satisfactory progress of the presentation of the water-power case before the International Joint Commission in the Lake of the Woods Reference.

The report is of an interesting character, and replete with views, diagrams, maps, &c., and is fully in line with the Government policy of making Canadian water-power resources known throughout the world. In this connection it is interesting to note that one suggested method of attaining this end is the use of moving pictures, films for which it is considered would be welcomed by engineering professional societies and most of the American Universities—the States being the country most likely to assist in the financial and commercial development of such water resources.

One section of the report on the prospects of electrical fixation of nitrogen deals with a subject which is much in evidence at the present time, although the author apparently holds out no very favourable prospects for such development for Canadian use in the near future, due, so far as fertilisers are concerned, to the possibilities of continuous cereal growing on the prairies at the moment, and the negligible amount of such fertiliser which would be needed with this soil if judicious rotation of crops were adopted in the future.

In summarising the position as regards the supply of nitrogen, the author points out that before the war Chile produced 2¾ million tons of sodium nitrate a year, of which 2¼ millions were exported, and appearances indicate that 50 years may pass before this source becomes short, and therefore the price of Chile saltpetre will for years regulate the market value of combined nitrogen.

As regards industrial sources, in 1913 the ammonium sulphate produced from coking plants was 1,365,700 long tons; the world production of cyanamide for the same year was 114,093 tons, and of Norway nitrate, 79,000 tons.

Combined nitrogen is important in more valuable forms as a constituent of coal-tar dyes and other coal-tar derivatives, explosives, collodion, celluloid, and other pyroxglins, prussiates, cyanides, nitrates, &c.

The electrochemical methods of obtaining atmospheric nitrogen consist principally of the Birkeland-Eyde, Schonherr, Pauling, and cyanamide (Caro-Franck)—which have been described at various times in our pages. Data is given showing that 2,000 lb. of nitrogen produced by the cyanamide process, only require 2·44 H.P. years, as against 9·52 H.P.-years for a similar production by the arc process.

Of the artificial sources, coke ovens have been mentioned; there is also the Haber process (not electrical) of combining hydrogen and nitrogen in the presence of a catalytic agent to form ammonia, which is largely employed in Germany at the present time.

[The author makes no reference to the Ostwald process—which is being exploited in this country by the Nitrogen Products and Carbide Co.—in which nitric acid is manufactured from ammonia, the latter being derived from calcium cyanamide; it is reported that plants are projected for 36,000 tons per annum in this country.]

The author concludes that arc processes are inefficient, and can only prove commercially successful when power can be cheaply obtained and the cost of marketing the product is low. The cyanamide process is successful, and is being developed in Canada by private interests; the Haber process is not electrical, and is possibly the most successful of all. [Again no reference is made to the Ostwald process.]

The author concludes that present action should be confined to securing an option on large blocks of power where required, and considering the question of establishing an experimental works.

Russian Electrification Project.—A semi-official journal, the *Torg. Prom. Gazeta*, says:—Some large Moscow capitalists have for some time been turning their attention to the mining and metallurgical industries of the Donetz Basin, and now these gentlemen have taken up the provision of electrical energy for all the metallurgical industries of South Russia, for which purpose a share company, under the style of Ugletok (Coal Current), with a capital of 150,000,000 roubles, is being formed. The statutes of the Ugletok concern, according to an official Russian paper, have already been drawn up and submitted to the proper authorities for confirmation. The organising bureau of the Ugletok has been installed in Kharkoff, and leading engineers and leading authorities are taking part in its operations.

In the explanatory report accompanying the statutes it is shown that the war has brought Russia face to face with a series of problems of first-class Imperial importance. Amongst these problems the most pressing is certainly the supply of fuel and metal. At the close of the war the country's needs in these respects will increase rather than diminish. The Ugletok Co. undertakes the execution of all the work of electrifying the national industry in regard to the wide region commonly known as metallurgical South Russia, which includes the Donetz coal and anthracite industry, blast furnaces, and metallurgical factories, the Krivoirog and the Nikopol manganese and iron mines, the salt industry, and a great variety of manufactures; besides a rapidly developing and extensive agriculture and quickly growing towns, all of which are making a continuously growing demand for electrical energy.

A preliminary estimate of the total power of the electrical stations in the collieries of the Donetz Basin gives the figure of 75,000 KW. If we take as a basis the possible maximum consumption of electrical power in the coal and anthracite concerns of the Donetz Basin, the total quantity of power used there would be 173,000 KW., that is almost two-and-a-half times greater than at present.

Besides the coal mines, the metallurgical concerns of South Russia are large consumers of electrical energy, amounting to about 287,000,000 KW.-hours per annum, and using, in most cases, blast-furnace gas for its generation. If the metallurgical works were to approximate their consumption of electrical energy to the proportion that has been attained in some individual factories in South Russia, the total annual consumption of energy might rise to 420 million KW.-hours. The difference between this and the above-mentioned figure represents the excess which apparently cannot be provided by the existing electrical power-producing plants in the metallurgical districts of South Russia, and offers a ready market for the disposal of the energy to be produced by the generating stations of the Ugletok Co.

Further, one of the serious results of the present war is the need for the development of the agricultural industry; and in that respect, the cheap electrical energy of the Ugletok may prove of invaluable assistance. The application of electricity for ploughing, for local transport, for the carriage of agricultural products, &c., constitutes a problem the solution of which lies within the province of electrical stations. Finally, the central stations of the Ugletok will be able to supply town factories and populations with electrical energy very much more cheaply than at present.

The Ugletok proposes to assist the mine owners in the electrification of their equipment by offering credit, by installing machinery, and purchasing such abroad, and so on. Finally, to emphasise the importance of the matter to the coal and anthracite industry of the Donetz Basin, it may be pointed out that, with the existence of the central stations of the Ugletok, new concerns from the very beginning would have all the advantage of the application of cheap electric power for the production of fuel and its transport to the railway stations. They would be freed from the need of finding good water for steam raising; and, what is particularly essential, they would be in a favourable position regarding labour, as the electrification of the mines effects a great economy in the use of man power. The normal annual increase in the production of mineral fuel in the Donetz Basin, calculated moderately at 10 per cent., makes a quantity of 150,000,000 poods a year, which is sufficient to occupy one main line in normal times. In other words, in order that the lack of railways may not choke the normal development of the production in the Donetz Basin, it is necessary to construct a new railway every year. It is hardly practicable to calculate on such a rate of construction; and under such circumstances, the *rôle* of the Ugletok, which will reduce the unnecessary wear of rolling stock, gives it a character of Imperial as well as local importance.

Cheap electrical energy supplied by the Ugletok will save the town the trouble of finding coal for its own electrical stations, and make it possible even for poor people to use electric lighting; whilst electric tramways with cheap power will assist in solving the question of dwellings, which is now acute.

To accomplish all the purposes mentioned above, the Ugletok proposes, in the first place, to erect in the coal-producing districts of the Donetz Basin three large electric stations of 75,000 H.P. each. The current from these stations it is proposed to supply to the mines and factories in the basin itself, as well as to the towns and villages and industrial concerns in the governments adjoining the basin. But in the opinion of the founders of the Ugletok, the project can only be carried out if it is recognised as of Imperial importance; for the basic idea of "central" stations presupposes the laying of conductors over great distances, which means the expropriation of proprietorial rights, and the alienation and use of property belonging to others.

Central Station Employes.—With reference to our note of last week, Mr. H. H. Morton writes to say that it is impossible for him to reply to all requests for particulars of the National Engineering award, but anyone interested can obtain particulars at any meeting night of the 16 London Branches of the Electrical Trades Union, or direct from the General Secretary, 137, Great Clowes Street, Broughton, Manchester. The London Station Engineers' Branch (No. 1), meets every Monday at "The Old Queen's Head," London Road, Elephant, London, S.E.; Station Branch (No. 2) meets every Tuesday at "The Cross Keys" Hotel, Theobald's Road, Clerkenwell, and on Tuesday, May 22nd, a special meeting, to which all station engineers and switchboard attendants are specially invited, will be held at "The Cross Keys" Hotel.

Electrical Trades Union.—The following is a copy of the award of the Arbitrator in the matter of the National Federated Electrical Association and the Electrical Trades Union :—

"1. A difference arose between the National Federated Electrical Association (hereinafter referred to as 'the Association') and the Electrical Trades Union (hereinafter referred to as 'the Union') in connection with an application for an advance of wages made by the Union on behalf of electrical wiremen, electrical fitters, and their assistants employed by the firms in the Association. The difference not having been settled by the parties was duly reported to the Chief Industrial Commissioner's Department of the Ministry of Labour, who referred the matter for settlement by a single Arbitrator and appointed me, the undersigned, one of His Majesty's Counsel, to act as Arbitrator therein.

"2. I heard the representatives of the parties at No. 5, Old Palace Yard, Westminster, on March 12th, 1917.

"3. Since the outbreak of the war the electrical wiremen and electrical fitters in the London district have received two advances —namely, by an award of August 13th, 1915, an advance of ¾d. per hour, and by an award of July 15th, 1916, a further advance of ¾d. per hour, with *pro rata* advances to their assistants.

"4. The normal week is one of 53 hours.

"5. Including the above-mentioned advances, the present rate for electrical wiremen and electrical fitters is 11¾d. per hour, and for assistants 8¼d. per hour.

"6. The Union claimed a further advance of 2d. per hour.

"7. Having examined and considered the evidence, the contentions of the parties, and the various circumstances of the case, I determine and award :—

"That on and after the first full pay in April, 1917, the electrical wiremen and electrical fitters shall receive an advance of 1d. per hour, calculated as from and including the first day of April next, with a *pro rata* advance to their assistants, that such advances shall be regarded as war wages, and to be recognised as due to and dependent on the existence of the abnormal conditions now prevailing in consequence of the war, and that the said rates as increased by this award shall remain in force without alteration until August 1st, 1917, and thereafter subject to four weeks' notice by either the Association or the Union after the said August 1st.

"(Signed) WILLIAM W. MACKENZIE.

"Dated *March 17th*, 1917.

"9, King's Bench Walk, Temple."

In reply to an inquiry by the Electrical Trades Union as to the meaning of the term "boys and youths" in the finding of the Committee on Production of March 1st for the Engineering and Foundry Trades, Sir G. R. Askwith says that the Committee had in mind that the 5s. per week having been granted to meet the increased cost of living, should be given generally to all male persons of 18 years of age and upwards. The intention of the Committee was that apprentices should be included in the term "boys and youths," and the 2s. 6d. per week awarded to them should be paid to all boys and youths under 18 years of age, in addition to any increases or bonuses, whether these were granted prior or subsequent to January 1st, 1917.

Science and Industry.—It has already been announced that the estimates for the Board of Education contain a grant of £1,000,000 towards the establishment of a new and permanent Department of Scientific and Industrial Research. This money will be paid to the account of the Imperial Trust for the encouragement of such research, and the Committee of the Privy Council will be authorised to order grants for an agreed period to approved trade associations, by way of supplement to the funds of these associations. An item of £7,250 appears in the Civil Service Estimates for the creation of the staff of the department, £1,500 being for the salary of a secretary and an assistant secretary. Men of science desire an explanation of the meaning and use of the new venture, and to this end Sir Joseph Larmor, Unionist member for the University of Cambridge, has given notice of his intention to move the reduction of the vote by £4,000.—*Daily Telegraph.*

National Insurance (Unemployment) Acts, 1911 to 1916.—Contributions are payable in respect of :—

2,224 X. Workmen who are employed in an establishment carrying on any trade insured under the National Insurance (Part II) (Munition Workers) Act, 1916, and who are engaged in shunting railway vehicles which are used mainly on the premises of the establishment.

2,226 X. Workmen engaged in the manufacture, installation, and repair of instruments for sending or receiving sound under water.

2,237 X. Workmen engaged in the manufacture of electrical cooking and heating apparatus.

Contributions are not payable in respect of :—

2,248. Workmen (other than those engaged in sawmilling or machine woodwork) engaged in the work of handling, preparing, and creosoting telegraph poles and other timber.

Bill Relating to Company Directors.—In the House of Commons, on Tuesday, Sir Albert Stanley (President of the Board of Trade) presented a Bill to provide for the disclosure of certain particulars respecting the directors of companies, and it was read a first time.

British Empire Producers' Organisation. — At the luncheon meeting of this organisation, on May 24th, at the Savoy Hotel, Sir Edward Carson will be the guest, and Admiral Lord Beresford will preside.

Institution and Lecture Notes.—Illuminating Engineering Society.—The seventh annual report was presented at the annual meeting on the 15th inst. The Society, dealing with the scientific and the industrial aspects of a wide subject, unites on common ground electrical engineers, gas engineers, manufacturers of lamps and shades, physicists, ophthalmic specialists, architects and surveyors. This branch of engineering has been recognised by the appointment under the Department of Scientific and Industrial Research, of a Joint Committee on Illuminating Engineering. The successful union of these various interests is largely due to the efforts of the hon. secretary, Mr. Leon Gaster, during the last 10 years. Mr. Gaster is a British subject of Roumanian origin, and is thus doubly associated with the cause of the Allies. All the male members of his family in Roumania and in England who are of military age are fighting in this cause, and one of his nephews was recently killed in Roumania.

The Aeronautical Institute of Great Britain.—A paper is to be read by Mr. E. A. Allcut, of Messrs. W. & T. Avery, Ltd., on "The Testing of Materials for Aeronautical Construction," before the Institute on May 24th, at 8 p.m., in the Central Hall (facing Westminster Hospital). Our readers are invited by the Institute to attend the meeting.

Institution of Electrical Engineers.—The NEWCASTLE LOCAL SECTION Committee has addressed the following letter to Mr. C. P. Sparks, President :—"The members of the Newcastle Local Section Committee beg to send greetings to you on the occasion of the annual general meeting of the Institution in London, and to convey their appreciation of the progressive measures which the Council have entertained during the period of your presidency. They realise that a very large amount of your valuable time must have been devoted to this work, and are confident that this will have a most important bearing upon the immediate and future development of the electrical profession. On behalf of this Local Section, they wish to thank you for the attention given to proxy voting, and other steps having for their object a closer touch between the Council and the provinces.

"In their desire to be of more assistance to the Council, they welcome your proposal to advise the Local Sections periodically by letter of any matters of moment which the Council consider opportune to confide in the Local Section Committee.

"The members of the Committee also beg to tender their loyal support to your successor in office, Mr. C. H. Wordingham, and respectfully to declare their whole-hearted approval of his nomination as president."

The result of the election of Council of the Institution, announced last night at the annual general meeting, was as follows:—President, Mr. C. H. Wordingham ; vice-presidents, Messrs G. W. Partridge and W. B. Woodhouse ; hon. treasurer, Mr. J. E. Kingsbury ; ordinary members of Council, Messrs. Ll. B. Atkinson, W. A. Chamen, J. S. Highfield, Sir W. Slingo, Lieut.-Colonel H. C. Sparks, and Mr. A. P. Trotter.

Institution of Mining and Metallurgy.—On Thursday next, May 24th, at 5.30 p.m., a paper by Mr. W. R. Ingalls, on the question "Shall Great Britain and America Adopt the Metric System?" will be read and discussed, at the rooms of the Geological Society, Burlington House, Piccadilly. The presence at the meeting, and participation in the discussion of the paper, of members of the Institution of Electrical Engineers and other engineering societies will be welcomed by the Council of the Institution of Mining and Metallurgy. Mr. Ingalls is the President of the Mining and Metallurgical Society of America, and of the American Institute of Weights and Measures, which was recently formed expressly to combat the rapidly-growing movement towards the adoption of the metric system in the United States ; the tenor and purpose of his paper may, therefore, be easily predicted.

Appointments Vacant.—Assistant for mains testing, &c., and electrician-in-charge, for the Borough of Hornsey Electricity Works. See our advertisement pages to-day.

Electric Chicken Brooding.—The *Journal of Electricity*, in the course of a short article on the above subject, states that the electric brooder is built in round, square, or oblong shape, in capacities from 50 to 1,200 chicks. The tops of the hovers are usually made of wood, insulated inside with asbestos, and supported on short legs. Strips of canvas or oilcloth reach to the floor and retain the heat, the strips being cut into small flaps to allow the chickens to pass in and out. The circular-top hover has a central heater in the top ; the other types have coiled elements arranged round the top. The air, when heated, banks against the insulated top, and settles down upon the backs of the chickens ; suitable air vents are also provided for ventilation, and a thermostat for automatically regulating the temperature is fitted a few inches below the top.

A well-constructed brooder is usually provided with about 100 watts capacity per 100 chicks, and the energy consumption averages about 20 KW.-hours per 100 chicks.

The electric brooder has almost all the advantages of the electric incubator, being a time and labour saver, and producing stronger chickens than those brooded by fuel heat.

Statistics show that an average of less than 50 per cent. of the chicks are raised to the roosts with many brooders now in use, while actual tests over 18 months with a large number of electric brooders show that the proportion with them has been raised to above 85 per cent.

The relative cost of producing heat per 100 chickens, with 600 B.TH.U. gas at $1 per 1,000 cb. ft., is $1·00 ; with distillate, at 8c. per gallon, $·45 ; with electricity, at 2c. per KW.-hour, $·40.

The improved results obtained with electricity would, in any case, warrant a higher heat cost.

Electric Invalid Chair Appeal Case.—Some months ago we drew attention to the proceedings before the Hampstead magistrates when Mr. Elieson was summoned, and a nominal fine imposed, for using an unregistered motor-car and for driving a motor-car without being licensed—the "motor-car" in question being the little electrically-driven bath chair for invalids, of which he is the inventor. Notice of appeal was given, and, according to the *Times*, the Lord Chief Justice, in the Divisional Court, on Tuesday last, dismissed the appeal, Justices Ridley and Avory agreeing.

From this it follows that users of these little vehicles, requiring about ¼ H.P. to drive them at a speed of from 2 to 3 miles per hour, will have to secure both a licence and registration, as, according to the Lord Chief Justice, it was impossible to say that this vehicle was not a vehicle impelled by mechanical power according to the definition of "light locomotive," and therefore it was within the statute!

Really—one wonders how the glow worms have so long escaped the lighting restrictions.

Fatality.—A Dudley electrician named Joseph Beaumont was on Saturday showing two officials of his firm round a transformer house, and explaining the 5,500-volt switchgear, when he accidentally touched a live wire and was killed, death being instantaneous. The body was badly burned, and holes were burned in the sheet iron casing of the switchgear.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The salary of Mr. NEVILLE APPELBEE, borough electrical engineer at Ashton-under-Lyne, has been increased by £50 per annum, as from April 1st. Three years ago it was suggested that an increase of £100 be given, but owing to the war Mr. Appelbee agreed to the withdrawal of the application at that time.

The Southend-on-Sea T.C. has appointed Mr. J. T. FAYLE, traffic superintendent of Leyton Corporation Tramways, to be traffic superintendent of the tramway system at Southend, at £3 10s. per week, rising by annual increments of 5s. to £4 per week. Mr. J. DANIELS has been appointed driving instructor to the Southend tramways, at £3 3s. per week.

At Erith recently, Mr. H. A. MUNDAY, chief clerk in the electricity and tramways department, was presented with a case of cutlery on the occasion of his marriage. Mr. J. C. Williams, engineer and tramway manager, made the presentation. Mr. F. J. Griffiths presided.

General.—Mr. LEO SUNDERLAND, of Messrs. Leo Sunderland and Co., has just received the Freedom of the City of London as Liveryman of the Worshipful Company of Glaziers.

Captain T. PRESTIGE has resigned his membership of the Electrical Conciliation Board of the L.C.C. Tramways. The Highways Committee recommends the appointment of Mr. W. H. P. GIBSON to fill the vacancy.

Roll of Honour.—Private R. W. SAINSBURY, a member of the staff of the Bristol Corporation electricity department, who has been serving in the R.A.M.C. in France for two years, has been awarded the Military Medal.

The death is announced of Mr. JOHN MARSHALL MCCULLOCH, of Litherland, Liverpool. He was employed as an electrician on board a hospital ship which was torpedoed.

Private F. C. STANFORD, Northumberland Fusiliers, who was employed in the permanent way department of the Leeds City Tramways, has been killed in action, aged 26.

Private H. A. LEACH, R.A.M.C., who has fallen in action, enlisted after many years' service on the Brighton Corporation Tramways.

Lance-Corporal L. P. CROUCH, who has been severely wounded in action, was until his enlistment last year articled to Mr. Hesketh, at the works of the Folkestone Electricity Co.

Private C. BATCHELOR, who joined the Royal Warwickshire Regiment four months ago, whilst in the turbine department of the B.T.H. Co., at Rugby, has been killed in action.

The *Times* states that Captain CYRIL W. K. HOOK, Manchester Regiment, who was killed on April 23rd, aged 21, was the second son of Mr. J. J. Hook, engineer of the Tata Hydro-Electric Co. When war broke out he was with Messrs. Mather & Platt, in Manchester.

Private FRANK SCOTTON, Oxford and Bucks Light Infantry, who was on the Rugby staff of the B.T.H. Co., has fallen in action.

Private H. JONES, Oxford and Bucks Light Infantry, who was in the machine shops at Rugby of the B.T.H. Co., has been killed in action.

Rifleman M. BURTON, K.R.R., who has fallen in action, was engaged at the B.T.H. works at Rugby.

Private FRANK POOLE, Royal Warwickshire Regiment, engaged at Rugby with the B.T.H. Co., has fallen in action.

P.O. J. ARMSTRONG, R.N.D., who has fallen in action, joined the service whilst an apprentice in the electrical department of the Carlisle Tramway Co.

Private G. W. CARRON, Machine Gun Corps, who was an electrical engineer with Messrs. Longdon & Co., Ltd., of Derby, has fallen in action, aged 27 years.

Bomb. F. A. ALCOCK, R.F.A., who was in the Corporation electricity department at Sheffield, has been killed in action, aged 24 years.

Private G. T. CLARK, who was with Messrs. E. J. Philpot, electrical engineers, of St. George's Street, Canterbury, has fallen in action.

The death in action, in France, is reported of Sapper R. VINE, R.E., who was on the staff of Messrs. Dick, Kerr and Co., Ltd.

CITY NOTES.

British Westinghouse Electric and Manufacturing Co., Ltd.

Following upon the speech of the chairman (Mr. J. ANNAN BRYCE, M.P.) at the recent annual meeting (ELEC. REV., May 4th, p. 495), it is now announced that extraordinary meetings of the company are to be held next week (21st inst.) to consider resolutions increasing the capital from £1,150,000 to £1,395,000. It is proposed to create 110,000 pref. shares of £2 each, and 500,000 deferred of 1s. each. The position is explained in the following interesting extracts from a circular issued to the shareholders, and published in the *Financial Times*:—

"You are doubtless aware that the Westinghouse Electric and Manufacturing Co., of Pittsburg, U.S.A., and its connections, control a majority of the preference and ordinary shares of our company.

"In view of the sentiment produced in this country by the war, and of the possible changes which may result in international economic relations, your directors have for some time been desirous that the control of the company should be transferred to Great Britain, and with this object your managing director went last autumn to America. Our American friends fully appreciated the reasons for the proposed change, but, as you may imagine, the difficulties were great, and it was only after lengthy negotiations that a basis of settlement was reached. This took the form of an agreement of option exercisable on or before June 1st, 1917, to purchase the whole of their preference and ordinary shares, together with their debenture stock, of which also they hold a majority.

"The agreement provides that a holding company shall be formed in Great Britain to buy the shares and debenture stock belonging to our American friends, and that this holding company shall issue to the American sellers in payment approximately £1,250,000 five per cent. first lien bonds, redeemable in 10 years, creating a first charge upon all the property, present or future, of the holding company.

"The holding company will have a capital of £500,000, divided into 300,000 six per cent. preference shares of £1 each, and 200,000 ordinary shares of £1 each. It is at present proposed to issue only 200,000 preference shares and 100,000 ordinary shares. One-half of the ordinary shares issued are to be allotted to the American vendors in part payment of the purchase consideration.

"Your directors consider this stipulation reasonable. The American company's holding in shares cost them nearly 20 years ago about £1,175,000, on which they had no return till the last four years, while their debenture stock cost them about £645,000. For their net cash investment of £1,820,000 they are to receive slightly less than £1,250,000 in 10-year bonds and half the profit beyond 6 per cent. of the holding company. The transaction is not of their proposing—they had no desire to part with their holding, and it is fair that they should retain some interest in an investment which, after having for so long given no adequate return, is just beginning to be profitable. Moreover, your directors are of opinion that it is for the advantage of your company that our American friends should retain such an interest in its profits as will make it worth their while to continue in the future to assist in its development, as they have done in the past. Our relations, extending now over nearly 20 years, have always been most harmonious and for our mutual benefit. They have taken a broad-minded view of these relations, as is shown by their willingness to fall in with the present proposals, and have always been ready to advise us and give us the benefit of their immense technical experience, without using their control to interfere in our management or limit our activity. Your directors are therefore anxious to have the benefit of their continued co-operation.

"It is provided that the holding company shall, in order to give additional security for the first lien bonds, acquire not less than 110,000 preference shares of £2 each in the British Westinghouse Co., and it is for the purpose of sanctioning the creation of these shares that you are now called together.

"Since the option agreement was made in December of last year there have been continuous negotiations with a view to putting your directors in a position to exercise the option, but you will easily understand that under the conditions produced by the war it has been difficult to bring them to fruition. Under British law it is not possible for a company to buy its own shares, and while it would, of course, be possible

for individual shareholders to combine to do so, such a combination was not possible under present circumstances.

"Under these conditions the only method was to find a financial group which would furnish the large sum necessary to carry through the provisions of the option agreement. Your directors are glad to inform you that a powerful group has now expressed its willingness not only to find the necessary funds for the holding company, thus enabling it to subscribe for the 110,000 new preference shares of your company, but also to give an undertaking to subscribe, as and when required, £500,000 in second debentures of your company on condition of an immediate issue to the holding company at par of 500,000 deferred shares of 1s. each, entitled to a dividend at the rate of 7½ per cent. after payment of dividends at the rate of 15 and 30 per cent. respectively on the preference and ordinary shares respectively, and carrying one vote for each share.

"As the proposals to be submitted to you possess the two-fold advantage of the transference of control to this country and of the provision of a substantial and much-needed addition of about £750,000 to your capital, your directors strongly recommend their acceptance."

Calcutta Electric Supply Corpn., Ltd.

During 1916 there were 23,575,211 units sold, as against 21,081,928 in 1915; number of houses connected increased by 693 to 9,461. The gross revenue increased from £224,206 to £237,353, and the net revenue from £162,922 to £167,370, exchange being calculated at 1s. 4d. per rupee. Including the amount brought forward and interest received on money at deposit, the profit is £199,847. After paying the preference dividend, putting £40,254 to depreciation and renewals, £2,500 to reserve, and paying 9½ per cent. on the ordinary shares, £2,500 is allocated to directors' extra remuneration, and £65,150 is carried forward subject to demands in respect of excess profits duty. The reserve for depreciation and renewals is increased to £215,835, and the reserve stands at £131,528. The expenditure on capital account during the year was £91,058, making the total £1,406,938. The demand for energy continues to increase steadily. Under the terms of its licence the company is bound to meet any demands for supply of current that may be made, but, on account of the difficulty in procuring additional plant, it has been found necessary to publish a notice that the company regrets its inability to accept applications in excess of the capacity of the available plant. Units generated 30,493,938, sold 23,575,211, used on works 5,909,355, not accounted for 1,009,372. Maximum supply demanded 8,750 KW. The public lamps number 196, and the public lighting units 687,253.

Kalgoorlie Electric Power and Lighting Corpn., Ltd.

In their report for 1916 the directors state that operations in Kalgoorlie have been continuously maintained, and all important customers are still taking current, though, in some cases, in less quantity than formerly. The continuation of the war has accentuated the shortage of labour, and from this shortage the most important of their difficulties, and largely those of the whole of the goldfield, have arisen; it has also caused a further increase in the cost of supplies and in taxation. The result of these unfavourable factors is shown in the decrease of gross profit for the year of £4,167, and (due to heavier taxation) in the net profit of £4,926. Notwithstanding the reduced profit, the dividend of 4 per cent. has been paid on the preference shares. £7,000 has been added to the debenture redemption fund, and £2,000 depreciation has been written off the value of the property. £1,007 is to be carried forward. The payment of the debenture issue falls due on December 31st next. Arrangements have been made to repay £31,200 of the amount upon the due date, and the balance by annual payments of £7,500. These deferred payments carry an additional 1 per cent. interest. The property has been maintained in good condition, and notwithstanding some difficulty in getting renewals and supplies, the machinery is in thorough working order. Annual meeting: May 24th.

Shanghai Electric Construction Co., Ltd.

The accounts for 1916 show a profit of £48,123 (plus £1,387 brought forward), against £31,084 for 1915. There has been put to reserve for renewals £10,000, and to reduction of preliminary expenses account £5,000. Dividends on the ordinary shares amount to 10 per cent. for the year, less income-tax, and £2,510 is to be carried forward. The loss by exchange on subsidiary coinage was £38,751 (12.11 per cent. on the capital). Transactions in Shanghai have been converted into sterling at an average rate of 2s. to the Mexican dollar, as against 1s. 9d. for the preceding year. During the year the general tendency of sterling exchange was favourable, owing to the rise in the price of silver. The percentage of loss by depreciation of subsidiary coinage has been sensibly lower during the past six months than the average rate experienced in 1916. The traffic and net receipts for the first four months of 1917 show improvement. 15 trailers have been added, making 70. Including seven railless cars, there are 167 passenger vehicles. Railless cars continue to operate successfully on one mile of route. A considerable expansion of business would result from an extension of this form of traction, and powers are being sought from the Municipal Council, which may be exercised when financial and construction cost conditions are more favourable. A site has been purchased on Soochow Road (cost Tls. 53,000) for the erection of new offices.

Buenos Aires Lacroze Tramways Co., Ltd.

The report for 1915-16 gives the following results:—Gross receipts, $5,883,262; decrease $217,389 m/n. The working expenses amount to $3,895,787, an increase of $135,005. The causes which have had a decided influence in these results are the large number of persons who have left the country owing to the European war, and the stoppage of works in general, which has resulted in thousands of workmen being unemployed. These have caused a decrease in the number of passengers, notwithstanding the liberality of services afforded. The figures cited leave a working balance of $1,987,475, from which must be deducted the amount of debenture interest and amortisation of municipal concessions, paving accounts, &c., leaving $644,519, plus $83,638 brought forward. Five per cent. of the total goes to the reserve fund, $32,225; 5 per cent. to the directors, $32,225; ½ per cent. to the syndic., $3,222; to the shareholders, $625,000; and there is to be carried forward $35,683.

Peel-Conner Telephone Works, Ltd.—The net profit for the year ended March, 1917, was £16,238, of which £2,000 has been put to reserve for depreciation. After adding £3,950 brought forward, paying the preference dividend £5,000, and a dividend of 2s. per share on the ordinary shares, £5,188 remains to be carried forward. The result for the year does not compare favourably with previous years, owing to the works having been mainly engaged on special work of a varied nature, with the result that a number of departments have at times not been fully employed. This conditions of affairs is likely to continue until the company can resume the manufacture of its normal productions. Annual meeting: May 21st.

South Wales Electrical Power Distribution Co.—The report for 1916 states that business showed an increase, the units sold amounting to 30,058,461, an increase of 1,090,805 units. After payment of all working expenses and interest on prior lien debenture stock, and making provision for depreciation of new plant, there was a surplus of £8,554, as compared with £6,756. This surplus, together with £3,999 in hand, enabled payment to be made of the full year's interest, £10,000, on the old debenture stock, and leaving £2,553 to be carried forward.—*Financial Times.*

Kidderminster and District Electric Lighting & Traction Co., Ltd.—The net receipts of the lighting undertaking for 1916 were £2,900, plus £2,782 dividends received in respect of investments, and £1,457 brought forward, making £7,141. After deducting administration and general expenses, interest on temporary loans and debenture stock, and providing £500 for renewals, there remains £2,499. There is to be put to reserve £500, the preference dividend absorbs £1,500, and £499 is to be carried forward.

Anglo-American Telegraph Co., Ltd.—For the year ended March, 1917, the dividend payments absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock. The balance at credit of revenue account (£69,456) includes £3,831 interest received, and £65,625 is available for the dividends for the quarter to March, 1917. Meeting: May 25th.

Merthyr Electric Traction & Lighting Co., Ltd.—The report for 1916 states that the revenue from all sources amounted to £27,179, as compared with £26,235. After deducting all expenses chargeable to revenue (including £3,456 for debenture and other interest), and providing £2,000 for renewals, the available balance, including £907 brought forward, is £5,408. A dividend of 6 per cent. per annum is to be paid on the ordinary shares, carrying forward £507.

Italy.—According to recent statistics, the capital invested in new industrial companies and additions to capital of existing companies in 1916 amounted to 438,100,000 lire. Of the companies in question, electrical concerns stood for 60,600,000 lire, chemical and electrochemical undertakings for 37,500,000 lire, and metallurgy (in which, presumably, electrometallurgy is included) for 132,600,000 lire.

Lewes & District Electric Supply Co., Ltd.—Total revenue for 1916, £3,338; expenses, £2,078. Interest produced £40, and there was brought forward £303. Debenture interest absorbs £440, there is to be put to renewals fund £600, and to be carried forward £595.

Calcutta Electric Supply Corporation, Ltd.—Final dividend on the ordinary shares at the rate of 12 per cent. per annum, for the six months ended December 31st, 1916, making, with the interim dividend paid in November, 1916, 9½ per cent. for the year.

Kidderminster & Stourport Electric Tramway Co., Ltd.—The profit for 1916, after providing for renewals, is £2,658, plus £99 brought forward. £500 is put to reserve, 3½ per cent. dividend requires £2,002, and £256 is to be carried forward.

Taunton Electric Traction Co., Ltd.—The receipts for 1916 were £2,900. £250 has been placed to renewals (says the *Times*), and £19 is to be carried forward.

STOCKS AND SHARES.

TUESDAY EVENING.

THERE is not much going on in the Stock Exchange. Russia, the industrial disturbances, the age limit, the submarines, and the daily expenditure upon the war make up a quintet of factors not exactly conducive to commercial enterprise. The British Government loans keep steady, and hold the other investments markets in firmness. In most first-class securities, the principal complaint still is that there is no stock to supply buyers when the latter come along, though these have shown a dwindling quantity of late, and there are some people putting their money on deposit instead of diverting it into Stock Exchange channels or subscribing to the Exchequer Bonds that are on offer.

The atmosphere is charged with uncertainty; and the question of the moment—from the financial point of view, at all events—is the length of time it will take the United States to become an effective force in the fighting lines. Judged from the many experiences of officers and men home from the Front with whom one comes into contact, there is more cheerfulness in the B.E.F. than there is at home.

Electric railway stocks are heavy, and in some cases lower, in consequence of the threatened strike of the 'bus drivers. Rumour had it on Monday that the tubes, trams, and 'buses would suspend running at six o'clock on the evening of that day; and although this turned out to be exaggerated, the situation was sufficiently unpleasant to lead to a little selling of Underground income bonds and Metropolitan consolidated stock. Optimists profess that the industrial unrest is the direct outcome of the fine weather, claiming that most men have been overworked for some time past, and that the sunshine offers them irresistible temptation to play. According to this theory, the various difficulties will adjust themselves in the course of a few days.

The engineers' strike is in part averted; but, in this particular section, dissatisfaction has been increasing, and want of tact on the part of some of the masters certainly aggravated the position. Engineering shares in the Stock Exchange lists have been scarcely affected at all, except in the negative way that when they come to market they are not quite so easy to place as they were a month or two back. Babcock & Wilcox hold their rise of 2 15/16. British Aluminiums are a trifle lower at 26s. 9d. Henleys 4½ per cent. debenture stock has risen to 81, an improvement of 2 points.

London shares keep good in the electricity supply group. Counties have further hardened to 10¼. Cities are ⅛ up at 11¾. The rest of the list is very hard, although there is not much doing. General Electric ordinary at 15 is 10s. up, and the preference have been changing hands during the last few days at 9⅝.

Marconis are showing marked activity in consequence of the success of the company in its recent lawsuit. The price of the shares hardened to 2⅞. The preference rose to 2 5/16; but the principal performer in the group, so far as business is concerned, is the Marconi International Marine, the price of the shares spurting from 37s. 6d. to 45s. Some of the demand responsible for this improvement is stated to emanate from the United States; and American Marconis have been good as well, with business done as high as 16s. 3d. Canadian Marconis remain neglected in the neighbourhood of 8s. 6d.; and Spanish & General Wireless Trusts keep about the same figure.

Cable shares are steady. Eastern Extensions are nominally 10s. down at 13½, but the dividend accounts for 7s. of this. Eastern Telegraph ordinary stock at 138 is 3½ lower, this, however, representing the dividend of the same amount. At 138, Eastern Telegraph ordinary pays £5 16s. on the money; and as the dividend is distributed free of tax, this is equal to 7¾ per cent. gross.

Eastern Extension pays slightly more; and having regard to the scarcity of good industrial investments, the recovery of the dividend is more than probable as soon as general conditions grow more favourable again. The Anglo group is firm, with a rise of 1½ in Anglo-American preferred. The ordinary stock has improved to 56½. Direct United States ordinary, at 6, were ex 2s. dividend last Friday.

Mexicans again stand out as one of the few bright spots round the markets, and the bonds of the Tramways Co. are both up 2½ points, the Firsts rising to 40, the Seconds to 30. Mexican Light & Power common has advanced to 14½, and the rest of the issues in this section are very firm, notwithstanding the lack of confirmation that Mexico had thrown in her lot on the side of the Allies. The weak tendency of the British Columbia stocks has made further progress, the deferred giving way 3 points, and a fall of 2½ occurring in the preferred.

Brazilian Tractions and Rio Tramway bonds, on the other hand, are better, thanks to the steady way in which the exchange advances. The Brazilian Traction directors, it may be recalled, decided to pay no more dividends this year, because of the drop in the rate of exchange. Since the company's report came out, however, the Rio rate has been mounting daily, with scarcely a break; and, from a little under 1s. it has risen to 13¾d. It is scarcely hoped that the Brazilian Traction board will change their decision in regard to the non-payment of a dividend at present, but the rise in the exchange will enable them to put the finances of the company upon a much more solid foundation, and this is justly held as a strong bull point. The preference shares rose to 90, and at the present price the return comes to £6 13s. 4d. on the money.

The British Westinghouse Co. has issued an important circular to its shareholders, convening meetings for the purpose of reorganising and increasing the capital of the company. The first meeting will be held next Monday, when no doubt further information will be given than is contained in the present circular. Put very briefly, the idea is to secure control in this country from the Westinghouse Electric Co. of Pittsburg, which at present holds a majority of the preference and ordinary shares of the British Westinghouse. A shrewd estimate of the reason for this might be that the company, as at present controlled, cannot expand as freely, in view of the Defence of the Realm Regulations, as it might be able to do under purely British control. No change has taken place in the price of the shares, which remain at 2 5/16. They are, of course, of the nominal value of £2 each, fully-paid.

British Aluminium fell 6d., but other shares of similar character remain firm. Armament shares are mostly better. Much interest and little business have attended the latest jump in the price of tin, the metal. The rubber market is quieter altogether. How the incidence of the excess profits tax will fall is still a matter of speculation, although it is capable of being estimated with more accuracy than on the occasion when the principle was brought into being. The general conditions which are militating against activity in Stock Exchange things as a whole play their part in the rubber market also; so that, while prices keep firm, the volume of daily business has substantially declined.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price May 15, 1917.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary	5	5	8½	—	7 2 10
do. do. do. 4½ Pref.	4½	4½	8¼	—	6 18 6
Chelsea	4	3	2⅞	—	5 4 4
City of London	8	8	11⅛	+ ⅛	6 16 2
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10½	+ ¼	6 13 4
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	10	5½	—	5 11 7
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3⅝	—	5 6 8
Metropolitan	8	8	2⅝	—	6 0 0
do. 4½ per cent. Pref.	4½	4½	3⅜	—	7 4 0
St. James' and Pall Mall	8	8	6¼	—	6 8 0
South London	5	5	2⅜	—	7 5 6
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	7	5⅜	—	6 5 9
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	16½	+ 1½	6 4 2
do. Def.	83/6	1½	22½	—	6 13 4
Chile Telephone	8	8	6⅛	—	6 15 4
Cuba Sub. Ord.	5	5	8½	—	5 17 8
Eastern Extension	8	8	13½ xd	—	*5 18 6
Eastern Tel. Ord.	8	8	138 xd	—	*5 16 0
Globe Tel. and T. Ord.	7	7	12½	—	*5 14 8
do. Pref.	6	6	10	—	6 0 0
Great Northern Tel.	22	22	88	—	5 15 9
Indo-European	13	13	49½	—	6 11 4
Marconi	10	10	2⅞	+ 1/16	3 9 6
New York Tel. 4½	4½	4½	99	—	4 11 0
Oriental Telephone Ord.	10	10	2½	—	4 14 1
United R. Plate Tel.	8	8	6⅝	—	*6 0 9
West India and Pan.	6d.	6d.	1	—	2 10 0
Western Telegraph	8	8	14	—	*5 14 4
HOME RAILS.					
Central London, Ord. Assented	4	4	60½	—	6 8 0
Metropolitan	1	1	23	— ¾	4 7 0
do. District	Nil	Nil	16	—	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A"	Nil	Nil	5/-	—	Nil
do. do. Income	6	5	79	—1½	*6 6 7
FOREIGN TRAMS, &c.					
	Dividend 1914.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	3½	—	8 16 0
do. 2nd Pref.	5½	5½	2⅝	—	—
do. 5 Deb.	5	5	69	+ ½	7 5 0
Brazil Tractions	4	4	47	+1½	Nil
Bombay Electric Pref.	6	6	10	—	6 0 0
British Columbia Elec. Rly. Pfce.	5	5	60	—	8 6 8
do. do. Preferred	—	Nil	42½	— 1½	Nil
do. do. Deferred	—	Nil	34½	—3	Nil
do. do. Deb.	4½	4½	64	—	6 12 10
Mexico Trams 5 per cent. Bonds	—	Nil	40	+ 2½	Nil
do. 6 per cent. Bonds	—	Nil	30	+ 2½	Nil
Mexican Light Common	Nil	Nil	14½	+1	Nil
do. Pref.	Nil	Nil	22½	—	Nil
do. 1st Bonds	Nil	Nil	37½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14	15	21⅞	—	5 2 0
British Aluminium Ord.	5	7	26 9	— 6d.	7 7 10
British Insulated Ord.	15	17½	192	—	6 17 3
British Westinghouse Pref.	7½	7½	2 5/16	—	6 9 10
Callenders	15	20	13½	—	7 11 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	20	22	8 5/16	—	6 13 0
Edison & Swan, £3 paid	Nil	—	1/16	—	Nil
do. do. fully paid	Nil	—	1⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	69½	—	5 15 2
Electric Construction	6	7½	(	—	7 10 0
Gen. Elec. Pref.	6	6	9¾	—	6 3 1
do. Ord.	10	10	15	+ ½	6 13 4
Henley	20	25	15½	—	8 1 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	11⅞	—	*8 8 4
Telegraph Con	20	20	37	—	*6 9 10

* Dividends paid free of income-tax.

WAYLEAVES.

In connection with the discussion on Mr. Vernier's paper, Mr. W. A. Chamen has addressed the following important communication to the *Journal* of the Institution of Electrical Engineers:—

As chairman of the Joint Committee of the Incorporated Association of Electric Power Companies and the Incorporated Municipal Electrical Association appointed for the purpose of drafting a Bill which it is hoped may be presented to Parliament at the earliest opportunity, I may say the question of wayleaves has engaged the attention of that Committee to a very considerable extent, and the following clause (No. 11) appears in the draft Bill:—

"11. The undertakers may within their area of supply or any extension thereof under section 6 of the Electric Lighting Act, 1909, or otherwise construct maintain repair alter and remove electric lines either over ground or under ground across over or under private property or common lands, rivers, railways, canals, tramways, aerial ropeways, pipelines, water channels, and the like, subject to the consent of the owners thereof, or without such consent (notwithstanding the provisions of section 7 of the Gasworks Clauses Act, 1847, as incorporated with the Electric Lighting Act, 1882, by section 12 thereof, and of section 10 proviso (*b*) of the Schedule to the Electric Lighting (Clauses) Act, 1899) subject to the issue of a certificate of the Board of Trade declaring the construction of such lines to be desirable on the ground of public utility and authorising their construction subject to terms and conditions as are hereinbefore provided. Any undertakers requiring to obtain such certificate shall make application therefor to the Board of Trade. Such application shall set out the purposes of the lines, the advantages of the routes proposed over any routes available by the exercise of their existing powers, or that there are no such routes, and shall be accompanied by a map showing the route or alternative routes proposed to be followed, the easements required for access thereto, the lands and other properties concerned, a schedule of such lands and their owners, and a certificate that copies of the map and notices of application have been served upon all such owners. Copies of any agreements which may have been made with any of the owners concerned in the construction of any part of such lines or of any consents given by such owners may be submitted with the application, or at any time thereafter until the Board of Trade shall have decided to grant or withhold the certificate.

Upon the receipt of any such application the Board of Trade shall notify the owners concerned, other than those last above mentioned, and invite them to forward to the Board of Trade in writing within one calendar month, any observations which they may wish to offer upon the construction of the lines or the routes proposed so far as their own properties are concerned. The Board of Trade, if it sees fit, may thereafter hold a local inquiry, or may decide to issue or withhold the certificate without such inquiry. The certificate issued shall be accompanied by a plan showing the route or routes approved by the Board of Trade with or without limits of deviation, but such routes or limits of deviation shall be confined to the properties scheduled by the undertakers in their application. The undertakers shall within six months of the receipt of the certificate serve upon all the owners concerned notices of their intention to construct such lines showing the proposed course thereof, and of the easements for access thereto, and at the same time serve notices to treat for the determination of the compensation to be paid where that has not been previously agreed upon.

The Board of Trade shall make regulations prescribing the scale of the maps, the forms of notice and observations, and the information to be submitted with applications and notices.

When the Board of Trade has decided to withhold the certificate, the undertakers shall not for twelve months, or for such period as may be determined by the Board of Trade, repeat their application, and then only subject to such regulations as the Board of Trade may make.

The exercise of the powers conferred by this certificate issued by the Board of Trade shall be subject to the following provisions numbered (1) to (6), and failing agreement between the undertakers and any owner of any lands, &c., as to the matters set out in the provisions of this section, the question shall be heard and determined by a single arbitrator to be appointed by the Board of Trade, and so far as possible all questions arising in respect of the line or lines authorised by any certificate of the Board of Trade shall be heard and determined by the same arbitrator sitting continuously.

(1) Payment by the undertakers to the owners of the property by way of lump sum or annual rent charge of such sums as may be agreed upon or awarded as compensation for the reduction in value of the lands by reason of the easements for the construction maintenance and repair of the line and access thereto.

(2) Payment by the undertakers to the owners of such compensation as may be agreed upon or awarded for damage done in the course of construction maintenance repair and alteration of such lines at any time arising.

(3) In arranging whether any wayleaves shall be granted in perpetuity or for any term of years due regard shall be had to the liability of the undertakers to continuously maintain any supply of electricity once given by them.

(4) Alteration from time to time of the route followed by any line on across over or under any lands upon such terms and conditions as may be agreed upon or awarded, but so that the alteration shall not cause any interruption to the supply of electricity.

(5) In making any award it shall not be competent for the arbitrator to decide against the express wishes of any landowner or occupier that any electric line shall be run overhead across any ornamental park garden or pleasure ground so as to spoil the amenity thereof.

(6) The Board of Trade may at any time revoke any certificates granted by them under this section upon such terms and conditions as they may determine, having due regard to the liability of the undertakers to continuously maintain the supply given by them."

It is not proposed under the Bill to proceed in any other way than through the present existing authority to whom all such matters are referred by the Electric Lighting Acts, namely, the Board of Trade, but if any other authority should be set up by Parliament for dealing with this question of wayleaves and/or any other questions at present dealt with by the Board of Trade, the transfer of this matter, along with any other such matters, to any other body, would of course be provided for in the Act appointing such new body. The procedure with regard to wayleaves in other countries has been considered, but it has been deemed advisable to proceed with the drafting of this clause on lines which fit in with the least possible trouble or alteration with the existing conditions in the United Kingdom. The Committee hope that the provisions of this clause give such power to undertakers and to the Board of Trade as it is reasonable to expect that Parliament will give, while at the same time safeguarding the interests of property owners, especially in instances where it might, from a purely utilitarian point of view, be desirable to run overhead lines across ornamental parks, gardens, or pleasure grounds in such a way as to disfigure and spoil the beauty of any such lands. Experience seems to show that the bare fact of the existence of such powers as those set out in this draft clause would suffice in nine cases out of ten, if not, indeed, in 99 cases out of 100, to cause the property owner to make reasonable agreements without the actual powers contained in the clause having to be called into operation at all. In present circumstances it is possible for one landlord possessing only a small amount of land to completely upset a scheme for the construction of any electric line not only overhead, but also underground, because he will not allow it to cross his property, or, if he is willing to allow it to cross, the conditions under which he is willing to do so render the scheme impracticable.

There is another point altogether, which has been referred to by the author, namely, that of the alleged right of veto by a local authority against the construction of any lines whatever overhead, even on private property. This alleged right of veto I do not think was ever intended by Parliament. It is not contained in section 14 of the Electric Lighting Act, 1882, and it is really only brought into section 10 (*b*) of the Schedule to the Electric Lighting (Clauses) Act, 1899, indirectly, and I cannot believe for a moment that the Committee of whichever House of Parliament first passed this wording intended that it should give to a local authority the power to prevent overhead lines being constructed on private property, where the public safety and convenience is in no way concerned. Section 1 of the Schedule to the Electric Lighting (Clauses) Act, 1899, states clearly that the provisions of the Schedule are to be read and construed subject in all respects to the provisions of the Electric Lighting Acts, which means the Electric Lighting Acts 1882 and 1888, and it is quite unreasonable to suppose that it was the deliberate intention of any Parliamentary Committee to place any further restrictions upon the erection of overhead wires than those contained in section 14 of the Electric Lighting Act, 1882, so far as the consent of local authorities is concerned. The wording of section 10 (*b*) of the Schedule to the Electric Lighting (Clauses) Act, 1899, is, of course, unfortunate, and if taken literally, as lawyers in these days seem to insist upon taking things, it may be held to give these very wide powers of veto to local authorities, but if the question were taken before any judge who would take a broad, intelligent, and common-sense view of the whole situation, I cannot think he would decide that this clause gives power to local authorities to prevent the erection of overhead lines across moorland or agricultural land or other tracts of country. As, however, the Board of Trade have maintained that section 10 (*b*) of the Schedule to the Clauses Act, 1899, does give an absolute veto to local authorities, without appeal in any shape or form, the Joint Committee have added the following section to the draft Bill:—

"12. Notwithstanding the provisions of section 14 of the Electric Lighting Act, 1882, and of section 10 proviso (*b*) of the schedule to the Electric Lighting (Clauses) Act, 1899, the consent of the local authority shall not be required for the placing of any electric line above ground, excepting along, over, or across any street, and such consent for the placing of any electric line along, over, or across any street shall not be unreasonably withheld. Any question whether such consent is unreasonably withheld shall be decided by the Board of Trade.

"This section shall only apply to the works of authorised undertakers carried out by them, remaining their sole property, and in regular use by them."

The effect of this is to take away all possibility of any claim by the local authority to have any power of veto over the construction of overhead lines on private property, and at the same time it provides that the consent of the local authority shall not be unreasonably withheld to the erection of any electric line above ground, along, over, or across any street, and provides a right of appeal to the Board of Trade, to decide whether any refusal to give such consent by any local authority is unreasonably withheld or not. It must always be remembered that there is no necessity for the local authority to set themselves up as guardians of the public safety, because the Board of Trade are already charged with that duty, which they carry out very scrupulously and effectively. If any local authority should know of any overhead electric lines being erected in such a way as to endanger the public, all they have to do is to draw the attention of the Board of Trade to the matter, and the Board of Trade will very effectively and efficiently do the rest. Many people may ask why these powers of which we complain should not be given to the local authorities as representatives of the public, who, they may say, can surely be relied upon to use them with all fairness and moderation. But the experience of many of us has proved only too clearly that these powers may be, and are, very grossly misused. For instance, a local authority owning a gas undertaking may, and sometimes does, make use of these powers to hamper the development of electric light, or even electricity supply generally for power purposes, within its district, being under the impression, apparently, that by so doing it is best serving its own ratepayers' interests by preventing competition with its gas undertaking. Then, again, any councillor having a grudge against an electric power company or other electricity supply undertaker, may so influence the council of which he is a member, as to cause that council to refuse to give the necessary consent. It is, therefore, quite wrong that these powers of veto, without appeal, should be placed in the hands of any local authorities. No one asks or wants free powers to electricity undertakers to run overhead mains along or across streets without reasonable and proper safeguards in the interests of the public as represented by the local authorities, or across private property without safeguarding the interests of the property owners. But I think that these two clauses in the draft Bill give the necessary relief to electricity supply undertakers, whilst at the same time amply safeguarding the public and the property owners.

HIGH-TENSION OVERHEAD TRANSMISSION LINES.

By G. V. TWISS, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Continued from page* 510.)

Choice of Type of Insulator.

Pin insulators necessarily transmit their load to the structure at a more or less long leverage. The proper function of pin insulators is, therefore, to support conductors in positions where comparatively small loads are to be dealt with, *e.g.*, on intermediate poles where the load is merely that due to the wind on the conductors. They may, however, also be used on small angles, the resultant load of which is of the same order as the transverse load. Where heavy loads are to be dealt with, such as at the termination of the line and at large angles, insulators which transmit their load direct without leverage, such as the shackle or straining type, should be used.

The shackle insulator, whilst sound mechanically, becomes excessively large, even at comparatively low voltages, owing to the fact that the upper and lower halves of its insulation are in parallel, so that it is only equal to a pin insulator of one-half its size (see fig. 6). This is often lost sight of, with the consequence that the straining points of some lines have only about one-half the insulation of the remainder of such lines.

Comparable insulation can, however, be readily obtained by the use of strain insulators of the disk type (see fig. 7), which can be made up of one, two, or more disks as required; and this practice is rapidly superseding the use of shackles.

The economical limit for pin insulators is 66,000 volts.

Merz-Hunter Split-phase System.

The two conductors of each split phase are sometimes supported on separate insulators as if they belonged to separate circuits, but more often they are supported on the same insulator specially made with two side grooves. This necessitates insulators having specially deep heads, and whilst this is permissible with the smaller sizes, it is questionable with large sizes, for the reason of expansion and contraction stresses referred to later.

When suspension insulators are used, the split conductors are attached to reel insulators attached to the lowest unit. It is important to short-circuit the insulation of one of the reels or to make it of a conducting material, otherwise the effect is that of a small capacity in series with the larger capacity of the disk, and the reel may be in a state of continuous flash-over even at working voltage.

When the two conductors making one split conductor are mounted on one insulator it is necessary to provide insulating distance pieces, known as spreaders, in the span. The usual spacing of these is from about 30 to 40 ft., depending upon the size of, and tension of stringing, the conductors. The form of spreader now largely adopted consists of a porcelain ring with two grooves in the periphery for the conductors, which are fastened thereto by means of small "stirrup" clips of copper (see fig. 8). In view of the vibration the bolts and nuts are locked by a soft copper locking device, which is pressed over the head of the bolt.

It is necessary that the two conductors making one split conductor should be strung with as nearly the same sag as possible, otherwise the result is unsightly, and the split conductors may "capsize," causing touching. It has been found difficult to obtain this exact adjustment of sag by ordinary means, and on some recent lines the strain insulators have therefore been provided with an adjusting device, as shown in fig. 9.

Poles.

It seems to be the general idea that wooden poles are not efficient for spans of more than 200 ft. or so, but in some cases they can be used at their greatest efficiency for much longer spans. Moreover, it has been considered that on pressures in the neighbourhood of 100 kilovolts, the length of the cross-arm necessary prevents the use of wooden poles. It is therefore of interest to note that one recent 100-kilovolt transmission line (the Montana Power Co., U.S.A.) is erected on wooden poles, the pole structure consisting of two 45-ft. wooden poles connected together by a single horizontal cross-arm from which the suspension insulators depend.

Poles made of single metal tubes are employed for telegraph and telephone lines and small electrical lines of the nature of overhead distribution lines, but they are not as a rule economical at loads approaching those which come upon an important transmission line.

There is a special type of tubular pole, namely, the Kay pole (fig. 10), which is a British invention, and is capable of being applied to transmission lines of the highest voltage. The facilities offered by this class of structure, particularly in regard to ease of transportation and erection, merit careful consideration, especially when a pole line has to be erected on the side of sloping ground or mountainous country.

Lattice Steel-work Poles (usually called masts).—Most of these structures fall within one or other of two classes, namely, narrow-base structures and broad-base structures.

Narrow Base.—In this class of structure the load is transmitted to the foundations by the lift on the one side and the thrust on the other side of the base, forming relatively to the structure an inverted T (see fig. 11). This class of structure is usually designed to transmit its load down to the horizontal base members and thence to the ground. There is, therefore, slight movement and considerable horizontal force at the ground-line, point A, and if this slight movement be resisted very considerable stresses will be introduced in the bracings B far beyond those which they would otherwise have to carry.

It would seem to be sound practice to design the base members as for the assumed condition of the structure acting about the point A, which, of course, would require the introduction of a suitable strut at the ground-line C. The design is not as a rule very efficient, and it is only justified where conditions of space prevent a broader base.

Broad Base.—With this design of structure, owing to the

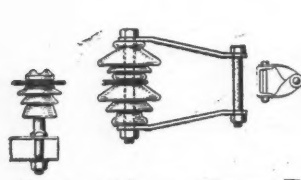


Fig. 6.—A Pin and a Shackle Insulator of Equal Insulation.

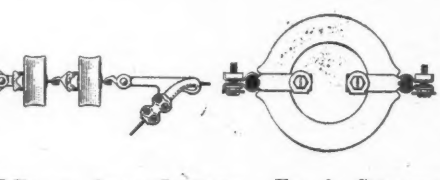


Fig. 7.—Strain Insulator of Disk Type.

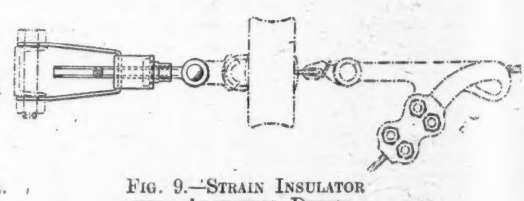


Fig. 8.—Spreader.

Fig. 9.—Strain Insulator with Adjusting Device.

wide spread, there is usually little horizontal reaction at the ground-line, and the base members, *i.e.*, stub ends, have merely to take thrust and pull (see fig. 11). This type lends itself to efficient design, but owing to the long lengths of bracings, &c., it is desirable that the ratio of the length to the radius of gyration for struts should be limited to a reasonable figure (say, 100 or so), otherwise a design which shows its full theoretical factor of safety may fail at a lower figure owing to the weakening of long struts by slight bends incurred in transit, or even due to sagging under their own weight.

Tension Members and Struts.—With a strut under an increasing compression load there is little change until it cripples, which it does quite suddenly, and it would develop its full theoretical factor of safety before crippling.

With a tension member under an increasing tension load, however, as soon as the elastic limit is reached it begins to

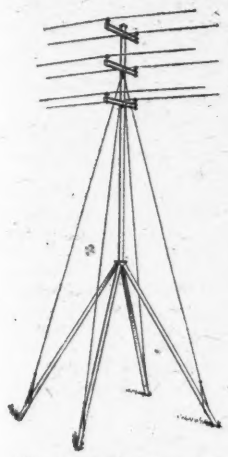


FIG. 10.—KAY POLE.

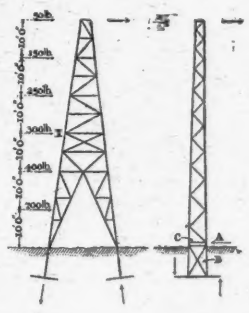


FIG. 11.—LATTICE STEEL MASTS.

stretch, and the point of the structure which such tension member should hold is no longer held in the manner intended. Hence an entire redistribution of the stresses takes place throughout the structure, which consequently fails at a lower load than that calculated.

It would therefore appear that when designing structures such as lattice steel-work masts, as the factor of safety for struts is taken upon the crippling load, the factor of safety for tension members should be taken upon the elastic limit, and not upon the ultimate strength.

Testing.—The usual practice is to test lattice steel-work poles by applying a pull at the top representing the load in the wires + the wind load on the pole itself equated to the top. The wind load is naturally distributed over the structure, and the design of a mast, to be correct, must therefore deal with this wind load as it occurs.

Fig. 11 shows a mast with a wind pressure of 10 lb. per sq. ft. equally distributed over it. The wind load on the lower bays will obviously be greater than that on the upper. If we equate the wind load by taking moments round the base of the mast, we find that it equals a load of 740 lb. applied at the top. If, however, bending moments are taken round the point X, it is found that the designed bending moment at this point = 7,000 ft. lb., whereas the equated load of 740 lb. gives a moment at this point of 22,000 ft. lb., or over three times more than the structure at this point is designed for. Hence the mast similar to that shown in fig. 11, tested with an equated wind load, failed at 25 per cent. less than its designed load, in one of the higher bays (near the point X), owing to such bays carrying not only their own load, but the equated increment of the large bays below. To equate the wind load in this way for the purpose of test would therefore seem to be unfair to the structure.

LINE INSULATORS.

A line insulator from the electrical point of view must be regarded as a more or less complicated electrostatic condenser with dielectric plates of porcelain (a dielectric of high specific capacity) and air (a dielectric of low specific capacity), the condenser plates being the conductor and its fastening, the pin or other attachment, and perhaps the layers of cement. All laws relating to condensers must be reasonably observed under what amounts to changing size and shape of the condenser plates due to rain, dirt, &c., and under frequencies ranging from normal to possible surge frequencies. At the same time, the insulator must sustain more or less heavy mechanical stresses caused by outside loads, and by inside stresses due to expansion and contraction under heat and cold of the different materials, individually and relatively.

Up to comparatively recent times it was the practice to design insulators merely to give certain flash-over tests dry and wet, and with sufficient thickness to ensure that under test, flash-over should occur before puncture. Considerable importance has also been attached to the leakage distance over the surface. Such figures are of little value, as the surface resistance given by such leakage distance will vary with the width of the leakage path, which, of course, varies considerably with different sizes and shapes of insulators. Insulators have also been specially designed with extra long leakage paths to work in situations exposed to deposits of dust, salt, &c. It would seem better to obtain the additional surface leakage distance required by using a correctly designed insulator of larger size than by altering a correct design to make it give a greater surface leakage distance for the same size.

Ability to withstand a flash-over test without puncture is not necessarily a criterion of good design in an insulator, as an insulator of indifferent design may still give such tests. An indifferently designed insulator may have badly balanced shells and air spaces, causing some portions to be unduly stressed electrically. Under increasing test pressure the air contiguous to such over-stressed portions breaks down, *i.e.*, becomes ionised and glows. Such ionised air, being a conductor, tends to increase the capacity of such portions and decreases the over-stressing, so that when the insulator is at its flashing-over point, it may be quite well balanced, not by its design, but by the corrective balancing action of the ionised air. Air, however, takes a definite (though minute) period to ionise, and a steep wave-front condition may not give time for the corrective balancing action of the ionised air, and the over-stressed part may break down and result in the puncture of the entire insulator. It would seem, therefore, that an insulator should be designed for surges with steep wave front rather than for normal conditions.

Lightning may directly strike an insulator and shatter it as by a mechanical blow, with or without electrical effects such as puncture or flash-over. Suspension insulators are, however, largely protected by the cross-arms, and pin insulators are generally somewhat protected by the poles or earthed metal-work projecting above them, so that an actual stroke on an insulator is fortunately not very frequent.

A lightning stroke though appearing to the eye to be one discharge, may be several separate discharges, each inducing in the wires a potential which may rise to almost any extent —only limited by the pressure necessary to arc from the line to earth—and the rate of rise may be of almost any magnitude, as, for instance, equal to that of a ¼ cycle of a frequency of a million per second.

Switching and arcing surges may rise to a potential of twice the line voltage, and will set up oscillations with a frequency depending upon the constants of the line or, say, 1,000 to 5,000 periods per second, which indicates the steepness of the front; but whereas the switching surge may only continue long enough to permit of two or three wave-trains, the arcing surge may continue for much longer, depending upon how quickly the arc is suppressed.

The first requirement is to balance the parts of the insulator so that under steep wave-front conditions it does not depend upon corona to relieve the over-stressing. To obtain correct balancing the following considerations must be taken into account:—

The mutual capacity of the parts.

The concentration of flux upon a relatively small electrode, as, for instance, the pin. (This tends to increase the potential gradient on the shells near such small electrode.)

The capacity of parts to earth. (This increases the capacity

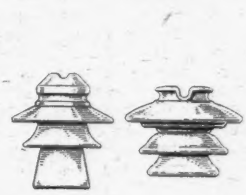


FIG. 12.—COMPARISON OF INSULATORS.

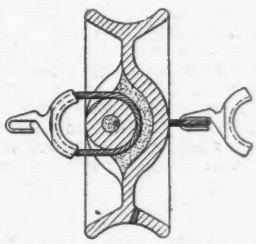


FIG. 13.—HEWLETT TYPE OF INSULATOR.

current, and hence the potential gradient on the shells nearest to the line.)

In addition to being balanced, the insulator should be proportioned to withstand the surges and oscillations of limited potential and frequency as set up by switching and arcing with an adequate margin against flash-over or puncture, and also so that when the almost unlimited rises of lightning surges occur, the insulator will be protected therefrom. This protection may be obtained by making use of the low dielectric strength of the air surrounding the insulator as a protecting gap or safety valve through which it may arc to earth and thus relieve the stress before damage can occur to the porcelain.

All well-designed insulators will be recognised under test by the small amount of corona formation prior to flash-over.

Pin-type insulators were first designed many years ago without great regard to the balance of dielectrics and their ability to withstand surges. These designs are generally tall, small headed, and elegant looking. If, however, these requirements

are regarded, the resulting design becomes more squat and wide to obtain the protecting air path and free arcing characteristic, whilst maintaining electrostatic balance, and thicker in the head to obtain the puncture strength and reduce the flux.

Fig. 12 shows a comparison of the earlier design of insulator with an insulator primarily designed for balance and ability to withstand high frequency, and the comparative behaviour of these insulators under test is characteristic.

Suspension insulators are usually of one or other of two types, viz., the Hewlett or interlinked type, and the metal hooded or cemented type.

Hewlett Type.—From the electrical standpoint the interlinking of the fittings causes a concentration of flux at the point where the interlinked fittings come closest together, *i.e.*, at the point of crossing. Practice has proved, however, that provided the insulators are made of high-quality porcelain, as, for instance, English porcelain, they give satisfactory service. The insulators as supplied in this country are fitted with endless steel-wire grummets connected together by an S-shaped fitting devised by the author (see fig. 13). The grummets are made on the insulator itself, and then cemented in to prevent the wearing of either the porcelain or the grummet. The cement being hygroscopic also has the effect of what amounts to increasing the area of the electrodes, and thereby reducing the flux density, and consequently improving the electrical characteristics of the insulator. As previously stated, this type of insulator is eminently suitable for use in conjunction with pin insulators on the straining points of the line. This design of insulator is also used on very high voltages, as, for instance, on the 88,000-volt lines of the Victoria Falls and Transvaal Power Co., and those made of sound porcelain, *e.g.*, the English ones, have given good service. On the very high voltages, however, the metal-hooded insulator is more generally used, presumably owing to its better electrical characteristics.

The Hewlett insulator as used for working in the horizontal position at straining positions has two flanges which cause it to have an excessively high flash-over voltage dry, which reduces the margin against puncture. As the result of experiments, the author has found a means of reducing the dry test by short-circuiting one flange in a position on the periphery opposite to the midway point between the two grummet holes (see fig. 13). The position is important, otherwise the spray test is also reduced, which vitiates its use. The following are comparative tests with and without the short-circuiting of the flange or "over-pressure release."

HEWLETT INSULATORS (SINGLE 6-IN. DISK).

	Ordinary without over-pressure release. Kilovolts.	With over-pressure release. Kilovolts.	Comparison with usual rating of pin insulator. Kilovolts.
Working	6	6	6
Flash-over under spray ...	35	35	37
Flash-over dry	80	56	54
Puncture (uncertain) ...	80	80	80

Metal-hooded Type.—The characteristic of the metal-hooded or cemented insulator is the concentric arrangement of the parts and the even distribution of flux, which makes the insulator very good from the electrical point of view. Considered individually, the suspension insulator is of very simple electrical design, but when arranged in a string in series, as for working at high voltages, some interesting features arise.

That the distribution of potential along a string of suspension insulators is not equal is well known, but it is desirable briefly to refer to it here in order to lead up to other matters. Suspension insulators arranged as a string have a capacity to one another which might be called "series capacity," and a capacity to earth which might be called "shunt capacity." The unit nearest to the line has therefore to carry the "series capacity" current, which is uniform throughout the string, plus the "shunt capacity" current of the units above it. Each successive unit above has a less amount of "shunt capacity" current to carry. The voltage gradient will therefore be steepest on the line unit, and less on each successive unit, the topmost unit nearest to the cross-arm having the least potential across it. The unbalancing will be the greater, the greater the ratio of shunt capacity to series capacity. Insulators, therefore, with large thicknesses of porcelain, such as a double piece or an extra-thick single piece, will have the smallest series capacity; and though such insulators may be of excellent design considered individually, yet a string of them in series may have very bad characteristics.

Such extra thickness becomes necessary with poor qualities of porcelain which have a relatively low dielectric strength, but such porcelain has a relatively low specific inductive capacity, so that the effect of bad porcelain in increasing the out-of-balance is cumulative. Inversely, the better the porcelain the higher the capacity due to the material itself and the thinner it can be for a given strength. With English porcelain which has high dielectric strength a 10-in. suspension disk, ¾ in. thick, has a flash-over value of 70 kilovolts, and a puncture strength of 156 kilovolts, and such a unit will give a much superior balance than, say, a two-piece insulator or an insulator 1 in. thick, particularly if of poorer porcelain. It will be noticed that whereas with the pin insulator it was desirable to get a thick dielectric, with the suspension insulator the opposite appears to be the case. With pin insulators, however, the shunt capacity is smaller in respect to the series capacity, and in any case the shells are readily proportioned (*i.e.*, graded) to suit; whereas with suspension insulators the effect is greater, and though feasible it is not very practicable to grade the units to provide for this. The series capacity can, however, under certain conditions be slightly increased by reducing the spacing.

One effect of the uneven potential distribution is that the flash-over of a string of, say, n units is less than the flash-over of one unit $\times$ n. The ratio of these two figures has been called the "string efficiency ratio," and is an indication of the out-of-balance of the string. It is to be noted, however, that just as with pin insulators, the effect of corona is to increase the capacity of the most stressed shells or automatically to grade them, so that under test at normal frequency the string efficiency ratio may indicate a better potential balance than is actually the case under normal working voltage. If the units are spaced over a certain length apart, flash-over will take place between the metal-work of each unit (fig. 14A), and further spacing apart will not materially alter the flash-over of the string. If, however, the spacing is reduced, the flash-over will take place over the entire string (fig. 14B), and when this condition is first reached the flash-over of the string might be slightly increased due to the better flux distribution. The spacing can, however, be further reduced up to the limit of the minimum spacing required by the fittings, and if this is done, the flash-over will be decreased, thereby lowering the string efficiency ratio.

Fig. 14C shows the effect of these movements. The spacing of the units closer together will have the following effects:—

1. The flux distribution will be better, due to the shortening of the path for such parts of the flux as pass through the air between the units.

2. The arc will be thrown out from the porcelain instead of drawn in, and so will reduce the possibility of shattering the shells.

3. The stresses on each unit will be reduced.

The last reason is a very important one. Under pin insulators it was shown that it is desirable to reduce the air gap or increase the thickness of the porcelain. The necessity for not increasing the thickness of porcelain in the suspension-type insulator has been discussed, so that the only course

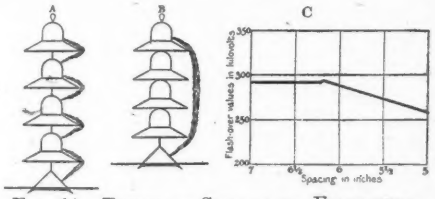


FIG. 14.—EFFECT OF SPACING ON FLASH-OVER.

open is to reduce the air gap, and thereby the stress which can come on any unit, including the line unit, and at the same time to reduce the time lag under high-frequency conditions. Yet that which provides the above important advantages and efficiency is to be stigmatised as bad efficiency, as judged by the string efficiency ratio.

The string efficiency ratio appears to be a reasonably accurate guide to the out-of-balance of a string up to the point of maximum flash-over for a given string; beyond that point, however, the string at least maintains its previous string efficiency, but gains in security by the reduction in potential which can come on to any unit.

This factor might be termed "string security factor"

$$= \frac{\text{maximum flash-over of string}}{\text{flash-over with reduced spacing.}}$$

Under rain conditions the balance of the string is improved owing to the increase of series capacity due to the wet conducting surfaces, and also due to the leakage current over such surfaces, which adds itself to the series capacity current. In consequence, after a certain number of units are added to the string, the flash-over under spray may become even greater than the dry.

(To be continued.)

Electroculture in Cheshire. — Lord Tollemache, of Peckfordon Castle, Tarporley, Cheshire, has taken up the system of electro-culture with enthusiasm, and with the professional assistance of Mr. S. E. Britton, borough electrical engineer, Chester (Chairman of the I.M.E.A. Committee on Electricity in Agriculture), is applying the system to a 14-acre plot. The apparatus is now in course of erection. We understand that Mr. Britton has also made all arrangements on behalf of his Corporation to experiment on a 1½-acre plot within the city, in connection with which he will have the assistance of the Corporation's horticultural and chemical experts, and that in Cheshire farming circles the idea of applying electrical methods to agriculture is being very favourably received, the only real hindrance being the difficulty of obtaining equipment under present conditions.

ELECTRICITY SUPPLY IN SHANGHAI.

We have received from Mr. T. H. U. Aldridge, M.I.E.E., engineer-in-chief and manager of the electricity department of the Shanghai Municipal Council, a copy of his report for 1916, which states that, notwithstanding the shortage of generating plant and trunk cables, a large expansion of business took place during the year. The plant being overloaded in the winter of 1916, the full supply for ordinary lighting, heating, and power could not be maintained without placing some of the more recently connected power users on a restricted supply between 4 and 10 p.m. There being few opportunities to clean or overhaul the boilers at the Riverside works, owing to the excessive demand for electricity, difficulties were met with in keeping them in working order, to which was added the breakdown of the No. 3 A.E.G. 5,000-kw. alternator (reported in our issues of July 21st and December 1st, 1916), the third of the four German machines to fail. The units generated at Riverside amounted to no less than 69¾ millions, an increase of nearly 15 millions, and at Fearon Road to 7¾ millions, an increase of 318,000 units, the whole of the available plant being run with practically no spare plant at all. A slight reduction in works costs was effected, the cost per unit sold being 0.531d. The plant capacity totalled 19,600 kw.; the load factor was 38.2 per cent., and the units generated 77½ millions. The units sold were distributed as follows: Private lighting, 14,285,888; public lighting, 1,058,772; heating and cooking, 899,585; power, 42,042,853; traction, 3,873,698. While lighting showed little increase, the consumption for heating and cooking increased 32.3 per cent., for power 37.2 per cent., and for traction 14.1 per cent., the all-round increase being 24.9 per cent.

During the year 144¾ miles of overhead cable were erected, and 20 miles of extra-high-tension cable laid underground. Transformers of 10,507 kw. were installed, and of 8,221 kw. disconnected, mainly owing to the substitution of three-phase for single-phase supply. The remainder of the public arc lamps were replaced by half-watt lamps.

A record number of motors was connected during the year, the total reaching 20,340 h.p.; the new connections represented an increase of 240 per cent. upon the h.p. connected during the previous year, and the aggregate increased by 25 per cent.

Electric vehicles were first introduced into Shanghai in 1916, the electricity department having purchased four light cars, a two-ton truck, and a 700-lb. truck. These have all proved so satisfactory that two more trucks have been ordered. Careful records show that the cars effect a saving of 9 per cent. per annum compared with cheap petrol cars, on a basis of 25 miles run per day; with a daily mileage of 50 miles the saving is about 30 per cent. There are three private cars in the city, and more are on order.

After meeting all interest charges, special depreciation on the old Fearon Road generating station (the steam generating plant in which will be scrapped in a few years), reserve for bad and doubtful debts, brokerage, and other special charges, in all amounting to £47,318, and after writing off £43,178 for depreciation, there was a net profit of £48,250. The result of the year's working was to yield a gross profit of 8.9 per cent. on the capital outlay.

The four 22,000-volt split-conductor trunk mains, made by the British Insulated & Helsby Cables, Ltd., connecting Riverside with the Fearon Road power station, are nearly completed. Preparations are being made for installing two 10,000-kw. turbo-alternators, the new 22,000-volt B.T.H. switchgear, &c., the designs for the concrete foundations and buildings having been made by the staff of the department. In spite of the difficult conditions, the General Electric Co.'s (U.S.) 10,000-kw. turbo-alternator has been delivered, a similar set by Messrs. Parsons is well advanced, and a 5,000-kw. turbine by Messrs. Fraser & Chalmers is nearly ready for shipment; a quantity of the auxiliary machinery has already arrived. Difficulty has been experienced in obtaining steelwork for the building from the United States. Mr. Aldridge compliments the British manufacturers on the progress made with the new plant in view of the restrictions and difficulties under which they are labouring.

The report is illustrated with a number of half-tone views of the newer plant, &c., and curves showing the progress of the undertaking.

RESERVED OCCUPATIONS.

Electricity Works Employés.

On April 24th Mr. H. Faraday Proctor, the hon. secretary of the I.M.E.A., wrote to the Secretary, Badges and Protected Occupations Section, Ministry of Munitions of War, 6, Whitehall Gardens, London, asking, on behalf of the members, whether it was desirable at this stage to apply for (*a*) protection, (*b*) substitution, for men over the age of 32 years (on January 1st, 1917), such as engine drivers, stokers, &c., &c., who were essential to the operation of certified undertakings, but who were not referred to in the Schedule of Protected Occupations (M.M. 130), or whether opportunity would be afforded for doing so when the calling up age was raised above 32 years.

In reply, Captain C. B. Joyner wrote under date May 1st:—"I am to inform you that as men over 32 in works engaged on munitions are not at present to be called up for Military Service, it will not be necessary for any applications to be made for their protection in cases where they are not included in the Schedule of Protected Occupations. If, however, it should in the future prove necessary to set free such men for Military Service claims may be made for their retention upon Form M.M. 81, as stated in paragraph 12 of Circular Letter M.M. 18. If substitutes will be required for such men in the event of their release at any future date, claims should be entered in column (P) of M.M. 82S in accordance with paragraph 9 of the directions for filling in that form."

Under date May 9th, Mr. Faraday Proctor communicated with members of the I.M.E.A., replying to the large number of inquiries that he had received on the above matter. Copies of the letters referred to were distributed with his communication. We quote the following extracts from the latter:—

"Sir Stephenson Kent informed our representatives on April 26th, 1917, that engine drivers and stokers in electrical generating stations are not protected under the code numbers 1601, 1604, and 1605 (White List M.M. 130). Protection will presumably be given under 'Professional Occupations and Administrative Staff,' code numbers 2001 and 2017, and has actually been given in at least one instance."

On careful perusal of the documents, it will be observed:—

"1. That 'Scheduled Occupations Certificates' Army Form 3476a, will be issued to every man entitled to protection under the White List, M.M. 130.

"2. Temporary protection will be issued to those men of military age who, although not covered by the White List, are not to be called up for the present.

"3. If a man is called up who is not protected, a claim may be made to the Dilution Officer on form M.M. 81 for his retention, provided always that

"4. Special claims should be reduced to the absolute minimum.

"5. It is men under 32 years of age who are to be called up.

"6. If, in the event of any man being liable to be called up either now or at any later date, a substitute is necessary, the claim for a substitute should be filled in *now* on form M.M. 82S.

"7. The claim for a substitute should be made, whether or no you are of opinion that an efficient substitute can be found.

"It is probable that the reason why the schedule of protected occupations is not wider is that in some exceptional cases it has been found possible for the work in these occupations to be carried out by men over age, or wholly or in part by female labour. This justifies the exclusion from protection of the male employés *as a class*, even though it be found necessary in nearly every case to protect such employés *as individuals, as groups of individuals, or according to locality*. Some of our members have refrained from claiming substitutes for men who should be protected although not coming under the White List, on the grounds that they are sure efficient substitutes cannot be found. In my opinion column (p) should be filled in in every case where the work of a man is necessary and it is not clear that means will be forthcoming for the carrying out of that work in the event, however remote, of that man being called up. I consider that it is better to claim even the impossible than to have no claim outstanding. In the event of the man in question not being protected or substituted the alternative is then for the man to remain at work, although unprotected."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

UNION OF SOUTH AFRICA.—In the Budget speech which was delivered in the Union Parliament on March 30th, it was stated that the Customs duties for the year 1917-18 remain unchanged.

A recent decision by the Commissioner of Customs places the rate of Customs duty on electric starters for motor cars as follows:

	Rate of duty.	Rebate for U.K. and reciprocating Colonies.
Chains	20 p.c. *ad val.*	3 p.c. *ad val.*
Adjusters and parts	3 p.c. *ad val.*	Whole duty.

SWEDEN.—The exportation of the following, among other articles, has been prohibited as from the dates mentioned:—

March 18th: Accumulator plates, and wooden boxes for accumulators, lined with lead; insulating tubes—steel armoured tubes and other kinds, and bends for conduits, also boxes for insulating pipes. March 31st: *Copper and alloys thereof with zinc, tin, or other non-precious metal, also aluminium and nickel, &c.; electrical machines—such as generators, motors, converters, transformers, and damping-

coils, also stators, rotors, current collectors, magnet coils, brush holders, and armature coils exported separately—provided that they are composed mainly of materials (other than iron) of which the exportation is prohibited; *zinc, unmanufactured, and manufactures of zinc.

*Extension of existing prohibitions.

NETHERLANDS.—The exportation of metals (except iron and steel) in any form has been prohibited as from April 10th.

By a recent decision the Customs duty on electric blowing machines for organs has been determined at 5 per cent. *ad val.* The value to be declared, for Customs purposes, of transformers (dutiable at 5 per cent. *ad val.*) should include the value of the quantity of oil contained in the transformers. This oil need not then be declared and subjected to duty separately.

ITALY.—A Royal Decree was published in the *Official Gazette* of April 4th prohibiting the importation of all foreign goods with the exception of (*a*) goods for account of the State; and (*b*) foodstuffs and raw materials for industries—to be designated by decree of the Minister of Finance. Provision is made for the issue of licences in respect of goods affected by the prohibition. The Royal Decree was to take effect on April 19th, *i.e.*, the day following that upon which the Ministerial Decree referred to in (*b*) was published officially.

SWITZERLAND.—A Federal Decree, dated March 28th, fixed April 1st as the date of coming into force of the new statistical tax on goods passing over the Swiss Customs frontier—see the ELECTRICAL REVIEW of March 16th.

UNITED STATES OF AMERICA.—The Supreme Court of the United States gave a decision on March 6th the effect of which is to annul the "5 per cent. rebate" clause of the United States Tariff Act of 1913, under which a discount of 5 per cent. of all duties imposed by the Act was to be allowed on such goods as were imported in vessels admitted to registration under the laws of the United States. The Court held the clause to be inoperative because it conflicts with existing treaties.

AMERICAN WEST INDIA ISLANDS.—An Act of Congress, dated March 3rd, provides for a temporary government for the West India Islands recently acquired by the United States from Denmark. Section 4 of the Act states that, until otherwise provided, all laws now imposing taxes in these Islands, including the Customs laws and regulations, shall in as far as compatible with the changed sovereignty, and not otherwise provided in the Act, continue in force and effect except that articles of United States growth, product, or manufacture shall be admitted free of duty.

PERU.—According to the official *Peruano*, an additional duty of 2 per cent. will be levied on all merchandise imported through the Custom House at Pisco, with the exception of imports in transit to the interior. The proceeds from this duty are to be devoted to the installation of new water supply and sewerage systems for Ica, Pisco, and Chincha Alta. The duty will continue to be levied until the completion of the project.

TERRITORY KNOWN AS "GERMAN EAST AFRICA."—It has been officially announced at Mombasa that until it is possible for the Administration in the territory known as "German East Africa" to establish its own Customs stations at Lake ports, all duties, &c., on goods imported from, or exported to Bukoba and Muanza (the only ports now opened) through the port of Kisumu, must be paid at Kisumu. On presentation of drawback specifications showing marks, numbers, description, and contents of packages exported to "German East Africa," and the number of the East Africa import entry on which the import duty has been paid, such specifications being duly certified as to the actual landing at Bukoba or Muanza of the goods covered by them, and after payment of the "German East African" import duty, refund of East Africa import duty will be granted. No drawback of duty will be allowed on goods from open stocks.

All duties on goods consigned under the regulations by the Voi-Military Railway must be paid at Mombasa, refund of East African import duty being payable at Mombasa only.

Further official announcements notify that the ports of Bagamoyo and Pangani have been opened as Customs stations. Hitherto these ports have been open for coastwise traffic only, no direct foreign trade being allowed (see the REVIEW for March 16th).

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,053. "Working signals, &c., by electric currents." J. JOHN & W. J. JOHN. April 30th.

6,054. "Intercommunication telephone systems." J. W. DUNGEY & C. B. KERSTING. April 30th.

6,081. "Electric torches." R. FALLOWS. April 30th.

6,094. "Systems of electric motor control." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). April 30th.

6,098. "Ignition magnetos." E. C. R. MARKS (Soc. Anon. des Etablissements L. Blériot). April 30th.

6,110. "Electric ignition apparatus for internal-combustion engines." C. A. ATHERTON. April 30th.

6,132. "Electric cut-outs, leakage detectors, &c." J. JOHN & W. J. JOHN. May 1st.

6,150. "Secondary batteries." D. P. BATTERY Co. & B. M. DRAKE. May 1st.

6,164. "Electrodes." E. E. GREVILLE. May 1st.

6,177. "Magnetically-controlled apparatus and methods of operating same." C. O. BASTIAN. May 1st.

6,185. "Combined electric switch, plug, and socket devices." V. HOPE. May 2nd.

6,196. "Electric irons, &c." CABLE ACCESSORIES Co., P. W. DAVIS & P. H. REEVES. May 2nd.

6,216. "Spark plugs for internal-combustion engines." J. A. DE VILBISS. May 2nd.

6,255. "Controllers for electric motor circuits." CUTLER-HAMMER MANUFACTURING Co. (Igranic Electric Co., U.S.A.). May 2nd.

6,280. "Electric heating devices." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). May 3rd.

6,285. "Electric welding apparatus." W. J. MELLERSH-JACKSON & T. E. MURRAY. May 3rd.

6,287. "Means for improving starting-torque and simplifying starter of single-phase induction motors." H. J. ELEY & M. W. WOODS. May 3rd.

6,298. "Sparking plugs." T. E. PONSOT. May 3rd (France, June 26th, 1916.)

6,308. "Electromagnetic lock-out switch or contactor." V. BREESE & A. WEST & Co. May 3rd.

6,309. "Electric motor-control systems." CUTLER-HAMMER MANUFACTURING Co. (Igranic Electric Co., U.S.A.). May 3rd.

6,320. "Electric heating apparatus." A. F. BERRY. May 3rd.

6,334. "Cooling appliances for engines and dynamos." G. E. BRADSHAW. May 4th.

6,335. "Detector for wireless telegraphy." M. L. LANCASTER. May 4th.

6,341. "Receivers for wireless telegraphy." M. L. LANCASTER. May 4th.

6,343. "Electric switches." G. O. DONOVAN & W. DONOVAN. May 4th.

6,344. "Electrical apparatus for detecting, measuring, indicating, or recording deviation of boreholes." H. BRIGGS. May 4th.

6,364. "Means for automatically recording calls in telephone systems." A. E. WOODS. May 4th.

6,383. "Electro-medical apparatus." E. E. GREVILLE. May 4th.

6,399. "Insulation for switches." H. H. BERRY. May 4th.

6,437. "Automatic micro-telephones." H. SYMES. May 5th. (New Zealand, June 26th, 1916.)

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

245. RECEIVERS FOR WIRELESS SIGNALS. Marconi's Wireless Telegraph Co. and G. M. Wright. January 6th, 1916. (102,821.)

246. RECEIVERS FOR WIRELESS SIGNALS. Marconi's Wireless Telegraph Co. and G. M. Wright. January 6th, 1916. (102,822.)

247. RECEIVERS FOR WIRELESS SIGNALS. Marconi's Wireless Telegraph Co. and G. M. Wright. January 6th, 1916. (102,823.)

484. MAGNETIC SEPARATORS. Fried. Krupp Akt. Ges. Grusonwerk. February 6th, 1915. (100,062.)

2,058. DYNAMO-ELECTRIC MACHINES. G. Schroeder. February 11th, 1916. (102,406.)

3,376. MAGNETIC SEPARATORS. A. Davies and E. Allen & Co. March 7th, 1916. (105,354.)

3,566. PROTECTIVE DEVICE FOR ALTERNATING-CURRENT SYSTEMS. A. E. McColl. August 17th, 1916. (105,356.)

3,603. METHODS OF AND MEANS FOR OBTAINING HIGH VACUA. British Thomson-Houston Co. (General Electric Co., U.S.A.). March 10th, 1916. (105,357.)

4,775. CARBON BRUSHES FOR DYNAMO-ELECTRIC MACHINES. J. E. Grant and Morgan Crucible Co. March 31st, 1916. (105,361.)

9,442. MEANS FOR CONNECTING ELECTRIC LINES, ESPECIALLY SUITABLE FOR USE IN TELEPHONY. Relay Automatic Telephone Co. & L. C. Bygrave. April 4th, 1916. (Patent of addition not granted. Cognate application, 14,099/16.) (105,363.)

4,983. ELECTRICALLY-CONTROLLED APPARATUS FOR INDICATING LIQUID LEVELS, AND THE RISE AND FALL OF GAS-HOLDERS AND CONTENTS THEREOF. L. V. Bourne. April 5th, 1916. (105,366.)

5,014. FOG SIGNALS AND COURSE SOUNDERS FOR VESSELS. D. Jones. April 5th, 1916. (105,369.)

5,054. MEANS FOR PROTECTING THE IGNITION APPARATUS OF INTERNAL-COMBUSTION ENGINES. Sunbeam Motor Car Co. & L. Coatalen. April 6th, 1916. (105,374.)

5,092. METHODS OF AND MEANS FOR ELECTRICALLY BONDING RAIL-ENDS. J. C. Lincoln. April 6th, 1916. (105,378.)

5,194. ACCUMULATOR CELLS AND SIMILAR VESSELS. C. C. Rattey. April 8th, 1916. (105,385.)

5,458. TELEPHONE RECEIVERS. Soc. Francaise Radio Electrique. December 28th, 1914. (100,281.)

5,477. APPARATUS FOR DISPLAYING ILLUMINATED PICTURES, ANNOUNCEMENTS, OR OTHER MATTER. W. G. Rider. April 13th, 1916. (105,410.)

5,521. TUBULAR EARTHS FOR ELECTRICAL CONDUCTORS. K. W. Hedges. April 14th, 1916. (105,411.)

5,933. ELECTRICAL SWITCHES. L. G. Caunter. April 25th, 1916. (105,422.)

6,476. VIBRATING MAKE-AND-BREAK DEVICES FOR USE IN ELECTRIC SIGNALLING. A. C. Brown. May 5th, 1916. (105,432.)

7,026. MEANS FOR LOCKING ELECTRIC LAMPS IN THEIR HOLDERS. J. R. Clay. May 17th, 1916. (105,440.)

7,303. SHADE HOLDERS FOR ARTIFICIAL LIGHTS. A. Hague. May 23rd, 1916. (105,443.)

7,963. CONTROLLERS OR SWITCHES FOR ELECTRIC MOTORS AND THE LIKE. F. J. Decker. June 5th, 1916. (105,453.)

8,625. DISTRIBUTORS FOR HIGH-TENSION MAGNETOS. Morgan Crucible Co. and G. S. Holland. June 19th, 1916. (105,462.)

10,184. INSULATING SLEEVES FOR ELECTRICAL TRANSFORMERS. Haefely et Cie., E. October 20th, 1915. (101,861.)

16,145. ELECTRIC CONTACT-BREAKERS OR INTERRUPTERS. G. F. Cooke. November 10th, 1916. (105,519.)

17,539. ELECTRIC CONDENSERS. G. Giles. December 9th, 1915. (102,619.)